Editorial

A CORRESPONDENT has sent me a cutting from a London Newspaper. In it a contributor has some unflattering things to say about the recent radio Exhibition held in that city.

His reaction was that, after examining the various exhibits, he was unable to find anything there in the radio receiving or television line which wasn't to be seen either in full or in part before the war.

In company with many others, he says, he expected to find many new ideas which grew up during the war to be incorporated in post-war productions. He couldn't agree with the various officials and politicians whose speeches and utterences were a great build up for the exhibits. He left the exhibition wondering what had happened to all the bright ideas he encountered in the services.

I am inclined to think there is much truth in his reactions. From reports received of present-day radio sets all over the world, and our experience of those produced in Australia., we see little in design which can be called revolutionary.

What then, has happened to all the knowledge gained during the intense period of war development?

In the first place, there have been great strides made in manufacturing materials and components, the results of which are hidden from the purchaser's eyes, and which don't materially affect circuit design. The performance obtained from tuning coils and intermediate transformers, for instance is considerably better now than it was. Methods of making good components have improved. Normally, these things would have made our radio sets much cheaper. Their effect however has been more than counter-balanced by rising costs of raw materials, services, and labour. The pre-war designs in general gave pretty good results, and few radio manufacturers have been ready to elaborate on them in the knowledge that prices would run even higher.

But the biggest factor of all in my view is that most of the really important war-time developments were in fields not specifically applicable to broadcast receivers. Radar is a good example of this. Its use of pulse-technique called for special valves and circuits which are not generally used in straight receivers.

But these techniques are of the greatest value in a huge array of electronic devices which are gradually permeating the whole industry. In this field, I cannot agree that the influence of war-time research is not seen. I do agree, however, that the average radio buyer may not be aware of them.

Two major matters of great moment at present are television and frequency modulation. Vital new information on circuitry and material was obtained through the study of radar. Much of this information has not yet been felt commercially. In England, they have decided to carry on with substantially their pre-war set-up for economic reasons, and in America no stable system has yet evolved.

We may be sure however, that if our domestic radios are not revolutionary for some time, the lessons of the last few years have not been shelved, even if the average man at present derives only secondary benefits from them.

John Moyle

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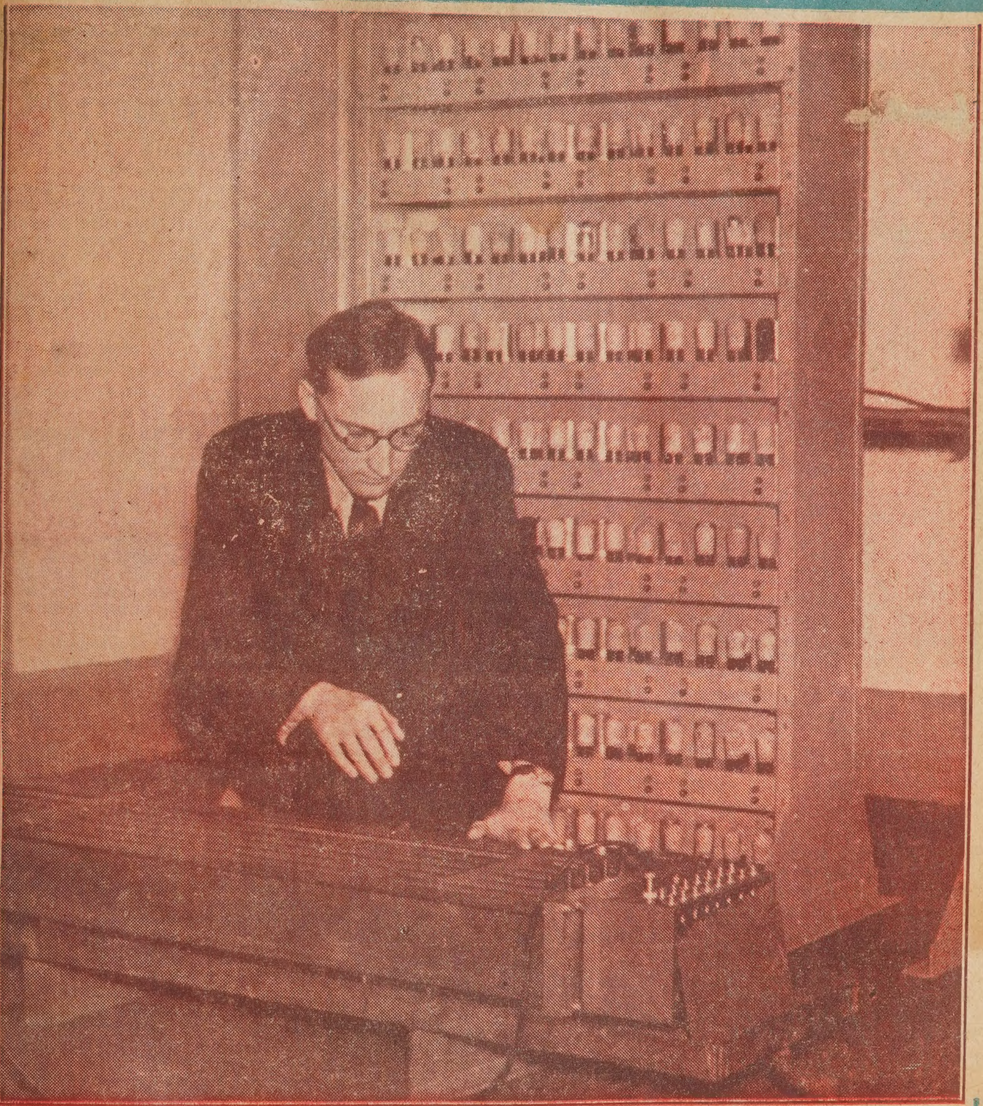
EDSAC—A NEW ELECTRONIC BRAIN



EDSAC—THE ELECTRONIC BRAIN—Thirty-three-year-old Cambridge professor Dr. H. V. Wilkes, director of the Cambridge mathematical laboratory, and ex-wartime radar backroom boy, is busy putting finishing touches to his electronic brain. This two-ton memory machine is the first in the world of its kind, and has been called EDSAC (electronic delay storage automatic calculator). The brain will complete 100,000 different calculations per minute and remembers by storing constantly moving electric and supersonic waves in a circuit of metal tubes filled with mercury. Questions will be fed in on punched tape, and answers delivered on a teleprinter. There are 32 of the 4ft. mercury tubes, more than 1000 valves, and miles of wire in the machine. Here Dr. Wilkes adjusts the mercury tubes which form the brains of the machine. Behind him are the calculating valves.

AUSTRALIAN SCIENTISTS AT WORK

How the moon looks from the earth. The moon has no atmosphere and cannot support life.

It is fairly certain, therefore, that the choes received at Belmar, NJ, in 1946 were the first to be definitely identified as coming from the moon. The equipment used by the Americans was a modified US Army radar set operating on a frequency of 111.15 mc. Signals at this frequency readily penetrate the ionosphere. The received echoes were quite strong, but varied considerably in amplitude over small time periods, and were obviously subject to attentuation from various causes during their long journey.

The possibility of using the moon as a target for radio signals arose during CSIR experiments in the reception of radio energy from the sun, or solar energy. Radiophysics scientists have been conducting the experiments for some time, operating special receivers at 80, 100, 200, 600 and 1200 megacycles.

On these frequencies, it is usual to observe a steady level of noise—the cosmic noise level—interspersed with noise peaks from various causes. Some of these causes have been isolated. Sunspots, for instance, may have a marked effect on signals, and their appearance often coincides with

Some months ago, American scientists were successful in receiving radar echoes from the moon's surface. They used special equipment employing high power and frequency. No further news of lunar bombardment was received until recently, when the Radiophysics Division of the CSIR announced that they had duplicated the feat during the course of experimental work concerning an examination of solar radiation.

THE difference between the two efforts seems to be that the Americans were concerned mainly in finding out whether the idea was practicable, whereas the Australians undertook the work to gain information for application in other lines of research. So far, there has been no mention of whether the results obtained in America have been put to any useful purpose.

VITAL UNIT

It does appear, however, that the moon will play a useful and even vital part in experimental and research work of the future. Encouraged by their success, the CSIR is considering other uses for their lunar guinea pig, and expect to obtain important information from it.

For many years, scientists have believed that radio signals sometimes escaped from the earth's atmosphere, travelled into outer space, and for some reason, returned again to the earth. In 1928, Stormer and Hals, of Norway, made observations concerning the transmission from the famous Dutch short-wave station PCJJ operating on 9.6 megacycles. They observed a return of signals from this station at intervals of from 3-30 seconds after they had been transmitted.

NOT THE MOON

The source of these echoes could not be accurately ascertained, but they were believed to be from concentrations of electrically charged or ionised particles thrown off from the sun, and situated somewhere in the interplanetary regions.

Later analysis of these observations indicated that it was unlikely that the moon itself was responsible for these echoes. In the first place, the power of PCJJ in those days was not high by modern standards, nor were the receivers used particularly sensitive. It is considered that the normal attenuation of the signals would weigh heavily against the reception of moon echoes. These might be expected to be well below the cosmic noise level, which is caused by various clouds of charged particles to be found in outerspace. As a result, no final conclusions were possible from the data obtained by Stormer and Hals.

a definite and measurable increase. Sunspots are due to huge upheavals in the enormous masses of gas which comprise the outer surface of the sun. These upheavals, the characteristics of which are known with fair accuracy, are frequently accompanied by the emission of large masses of ionised particles, the presence of which has a profound bearing on the transmission and reception of radio signals. By observing them, predictions concerning these radio "blackouts" can be made without difficulty, as they occur regularly at fixed times after appropriate sun-spot activity is noticed.

In addition to these variations in solar noise which are more or less predictable, other variations have been observed which are not so easily explained. There are two main causes of these variations. Firstly, the presence of electrically active clouds of particles in space, which could themselves generate the noise, together with other factors associated with the actual propagation of radio waves in outer regions as they travel from the sun to the earth, and sec-

HOW MOON ECHOES WERE RECEIVED

ondly direct radiations from the sun itself.

In examining these causes, the first and obvious step is to attempt to eliminate one of them in order to observe the effects of the other. Obviously our control over radio-active masses is practically nil, which leaves us to investigate the possibility of observing signals originating from a source which is not itself an emitter of active particles.

CONVENIENT BODY

The moon happens to be a convenient body in this respect. It is near enough to supply echoes from radio equipment of reasonable power, and appears to be quite inert as regards radio activity.

If pulses of radio energy could be sent to, and received from, its surface, any changes in the nature of the signal as sent and received would not be due to such activity. They would be caused by purely propagation factors.

It was for this reason that the Australians decided to experiment with the moon. The Americans were intent on receiving an echo and nothing else, but the CSIR wanted to use lower frequencies which are normally affected by ionospheric variations to a much higher degree. Accordingly they arranged to make use of the short-wave broadcasting station operated by the PMG at Shepparton, Victoria, and normally used for transmissions to Canada and the USA.

This transmitter was operated on its regular frequencies, which are 17.84 and 21.54 megacycles. The aerials are in the form of a broadside array with 16 elements and reflectors, giving a gain of 70 times. The beam width to an attenuation of 6 decibels is plus and minus 16 degrees.

RECEPTION

To receive the echoes when they returned to the earth, a receiving system was set up at Hornsby, NSW, using a specially built rhombic aerial aimed in the same direction as the transmitting aerial at Shepparton. This aerial also has a gain of 70 times, with a beam width of 14 degrees—slightly sharper than the transmitting aerial. Actually there are two rhombics in the array, the phase relationship of which can be adjusted to give slightly variable directivity to ensure the best possible alignment with the aerial at Shepparton.

The receivers are standard commercial types with suitably adjusted IF bandwidths.

The Shepparton transmitters were keyed from Hornsby by landline control, using a set of rotating cams to obtain the required groups of pulses. the two used most frequently consisted of a set of three, each 1/10th second long, and a single pulse 2.2 seconds long. The length of the keying landline is 300 miles.

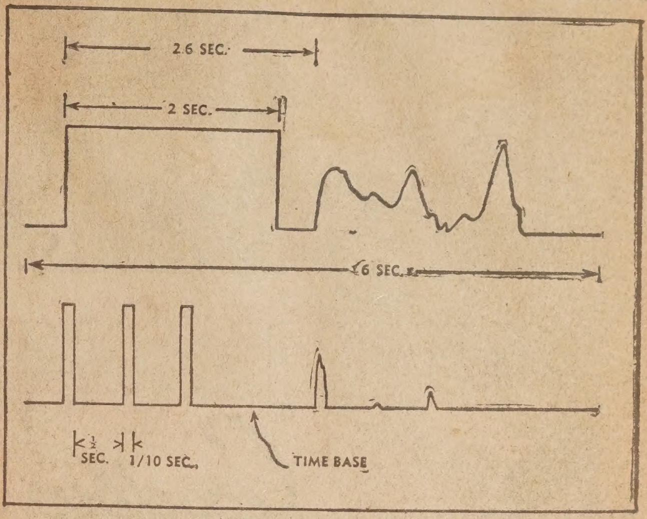
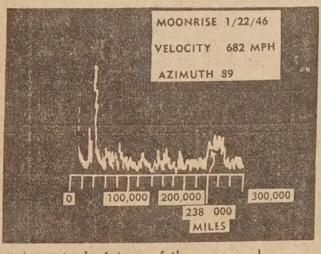


Diagram showing how C.S.I.R. moon echoes were received. The upper diagram shows firstly the square-topped pulse as transmitted, and the mutilated version of it as received 2.6 seconds later. Lower diagram illustrates the three 1/10th second pulses one half second apart.

CONVENIENCE

This set-up may appear somewhat awkward as against building a special equipment for the purpose. It was employed as being the most convenient method using existing facilities, at least during the early stages of the tests.

Because of the fixed positions of the aerials, it was possible to aim signals at the moon only when its position relative to the earth brought it within the beam of the aerials at a time when Radio Australia was not on the air. The third requirement was the suitability of ionospheric conditions which are not always the best for this type of work. However, all requirements were satisfied on the early mornings of November 6-10, for an hour shortly after moonrise.



An actual picture of the moon echo as received by the Americans last year. Note the transmitter pulse at the beginning of the trace. The miles scale has been added to indicate distance. Actually the pulse travels twice the distance between the earth and the moon—once there and once on return journey.

The first attempt on November 6 was unsuccessful, mainly because the moon had passed its optimum position before the transmitter became available. However, on the following night at 0355 EST, the moon was sufficiently high for the 17.84 mc. transmissions to pierce the F2 layer of the ionosphere, and the first moon echoes were received. This success was duplicated on the following three nights for an average of half an hour on each occasion, using 21.4 mc. on the 8th and 9th, and 17.84 mc. on November 10.

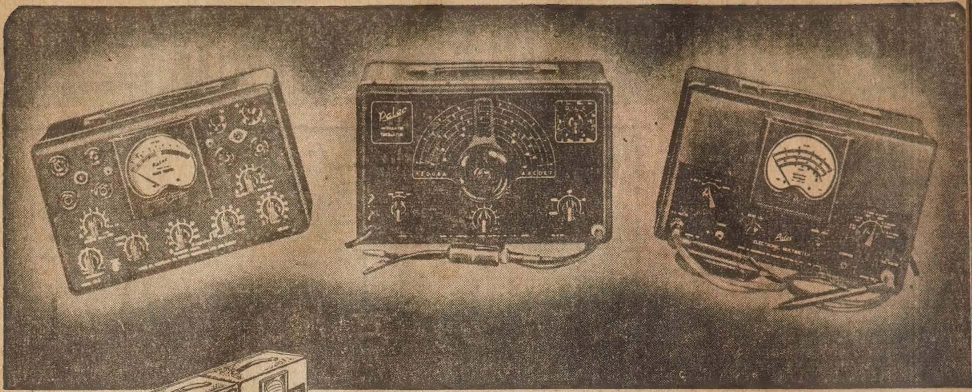
OBSERVING ECHOES

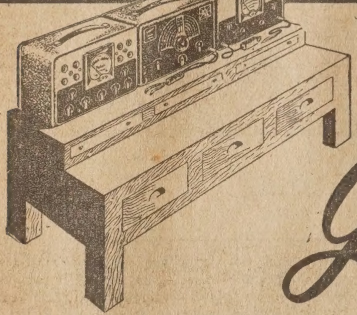
By this date, the moon had moved so that at no time was it suitably placed in the beams of the aerials.

The echoes were observed in two ways—by sound from a loudspeaker and by display on the screen of a cathode ray tube in a manner similar to that used in radar equipment using an "A" type scan.

This required a horizontal time base moving across the face of the tube in a horizontal direction, once every six seconds.

At the commencement of the trace, the square-shaped pulse of the trans-





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Range, 15 K/cs—30 M/cs in six direct reading bands.

Vernier Dial 54:1 ratio, calibration accuracy 1%.

Has cathode follower to prevent frequency modulation and attenuator reaction.

Signal generator pattern attenuator of five steps: impedance 11 ohms on lower settings.

Triple shielding and adequate filtering ensures a leakage of less than 1 microvolt at all frequencies.

Supplied complete with detachable dummy antenna, co-axial leads and 24-page instruction book.

Price: £32/17/6, plus tax.

Note: Each of these instruments is A.C. operated, 200-260 volts, 50 C.P.S., and can be operated from a battery by using external vibrator unit.

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PALEC Model V.T.M. (Probe) MULTIMETER

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Capable of quickly locating most obscure and elusive of intermittent, noisy, open or short circuits.

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Used with Model M.O. oscillator or equivalent, traces signal and determines stage gain in every channel from mixer to speaker.

Note: Oscillator employed must have good attenuator characteristics. *Ranges:*
(1) R.F.-A.F. six-range voltmeter: 0-2.5-10-25-100-250-1,000 volts A.C. Fitted with polystyrene bushed probe operating on frequencies up to 300 M.C. accuracy ± 0.5 db. to 100 M.C. Input cap., 10 uuf., loading equal to 6 megohms.
(2) High resistance D.C. six-range voltmeter: 0-2.5-10-25-100-250-1,000 volts D.C. Total load 11 megohms—giving over 4 megohms per volt on lowest range.
(3) Ohmmeter, six-range — from 0.5 ohms to 1,000 megohms.

Detachable co-axial leads, 20-page instruction book supplied. Employs 4 valves. Price: £29/10/-, plus tax.

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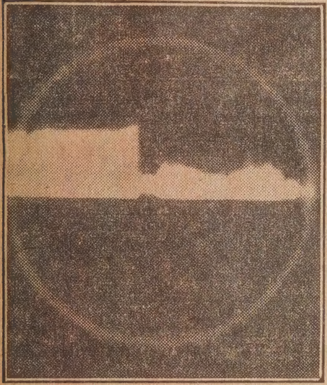
P.18.FP

mitter was shown for a period corresponding to 2.2 seconds. After an interval of .4 second, the echo was observed also for 2.2 seconds. The .4 second interval occurred because the time taken for signals to reach and return from the moon is 2.6 seconds. Thus 2.6 seconds would be the maximum pulse length useable before the end of one pulse would begin to overlap the beginning of the return echo. For safety's sake it was necessary to use a pulse length less than 2.6 seconds to allow clear separation between pulse and echo on the screen.

A diagram shown here illustrates the display seen on the face of the tube. It will be noticed that although the transmitter pulse is quite sharp, the return echo is considerably mutilated.

In the case of the group of three pulses, similar mutilations were observed. In some cases one of the pulses failed to return at all, indicating its diversion or attentuation en route.

It was previously calculated from knowledge of transmitter power, aerial gain, and distance covered, &c., that the maximum strength of the echo to be expected was 26 decibels above the average cosmic noise level. In fact, peaks of the return signal did approximate this strength, although portions of the signals were well below this level.

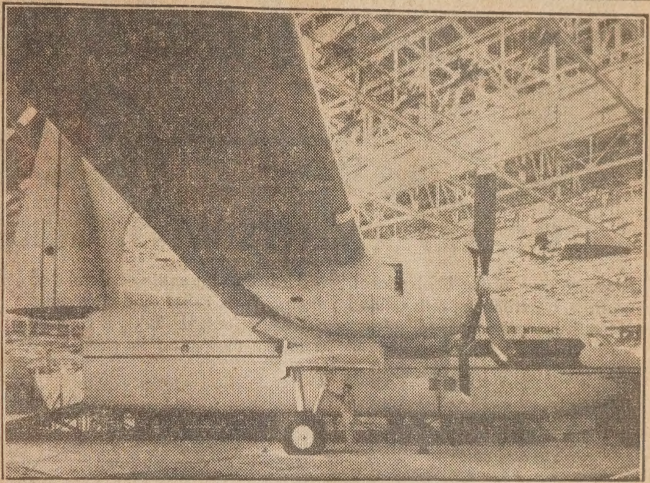


Actual photo of CSIR moon echoes using the 2.2 second pulse. Note fluctuation in echo strength. Compare with diagram on previous page.

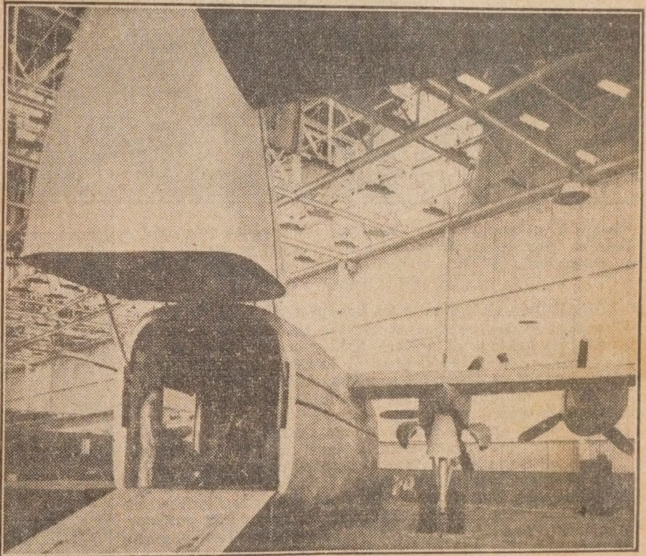
One of the most interesting observations made during this test was that the signals as received were approximately 50 cycles higher in frequency than those transmitted. This is assumed to be caused by the "Doppler" effect, often noticed when listening to the whistle of a train which falls in pitch as the train passes a given point and passes beyond it.

In this case, the rotation of the earth towards the moon caused the point of observation to approach it, the movement during the 2.6 seconds corresponding to the frequency shift of 50 cycles. This effect will probably lea dto valuable secondary conclusions not directly related to the experiment itself.

DEVELOPING A SKY - FREIGHTER



Mock-up of 100,000 pound sky truck built by Curtiss-Wright for demonstration of its unique loading features. The entire tail section is hinged and can be opened upward hydraulically, as shown here, to allow vehicles as big as 7½ ton trucks and heavy field guns to be driven aboard.



A 31,000 pound 155mm "Long Tom" field gun in the new Curtiss-Wright "Sky Truck" mock-up at the Columbus airplane plant of the company.

WHAT the Air Age has to offer in the long-promised field of flying freight—a 100,000 pound "sky truck" that can travel at 300 miles an hour and deliver 16 tons of freight, is shown above.

Designed from what engineers term a "mountain of specifications," set by both military and commercial authorities, the CW-32, is the first capable of loading and carrying all but the largest pieces of heavy, mobile fighting equipment needed for a modern army division and any commercial cargoes that can fit into a box car.

As a military transport, it is designed to carry everything from trench mortars to a 31,000 pound 155mm "Long Tom" field gun and from jeeps to the 7½ ton trucks upon which military armored forces depend for high mobility.

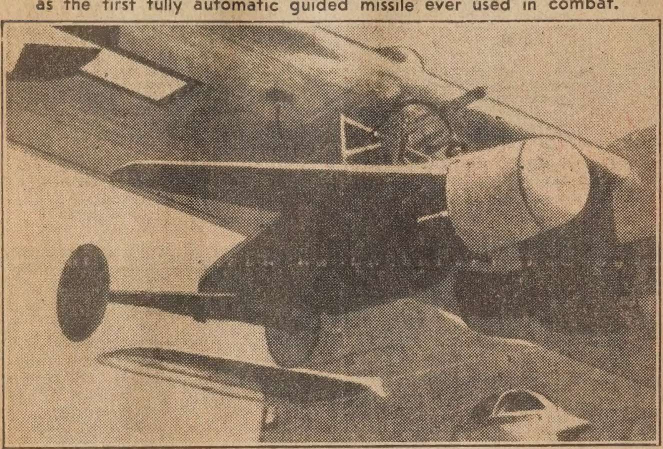
Part of its efficiency is contributed by a unique loading system. The entire tail section of the aeroplane is hinged and can be opened upward hydraulically. Vehicles as big as 7½ ton trucks and heavy field guns can be driven aboard through the open end.

Because of its high wing design, a 30-foot highway trailer truck can drive alongside under the wing and discharge cargo directly into the aeroplane, through side doors at truck-bed height to cut loading and unloading time to a fraction of that now required for air shipping.

Technical Review

U.S. EXPERIMENTS WITH GUIDED MISSILES

A recent issue of the US National Standards Bulletin contains details of wartime experiments with guided missiles. Both radar and television techniques were examined. Most successful project, the BAT, is claimed as the first fully automatic guided missile ever used in combat.



The BAT is equipped with both transmitting and receiving radar, and includes gyroscopic stabilising and a servo system to operate the control surfaces. It was very effective against the Japanese in the last year of the war.

DESIGNED to glide silently at the speed of a fighter plane, with a 1000lb. bomb as cargo, the BAT is carried under the wing or fuselage of a Navy fighter or bomber and may be released at a distance as great as 14 miles from the target. Once the crew of the mother plane has located a ship or other target, the missile is set for this particular target and the release button is pushed.

From then on the BAT automatically follows every manoeuvre of the target until it eventually strikes home, while the mother plane is free to proceed as its pilot wishes.

The code name "BAT" suggests the principle upon which this guided missile operates. A live bat gives out short pulses of sound and is guided by the echo, thus avoiding collision in the dark. The BAT missile emits pulsed microwave electromagnetic radiation and is directed by the radar echoes from the target. The radar robot pilot can, of course, "see" the target under any conditions of visibility.

In normal usage the target is first located by the standard search radar of the mother plane. The plane is then headed toward the target, and the radar transmitter and receiver in the BAT are aimed in its direction. Target data from the radar in the missile is displayed on a separate indicator in the mother plane under the control of the operator.

After the radar equipment is manually adjusted to the proper conditions, it is switched to automatic tracking, and the missile is released. Echoes from the target are continuously detected by the radar receiver in the missile, and the output supplies corrective signals to the flight-control units so as to direct the missile toward the target.

Summarised, the advantages of the BAT are long range, improved accuracy, low angle of flight, high payload, and self-guidance after release.

The Bat is equipped with a gyroscopic stabilising unit and servo system to move the control services of the air stabiliser. This equipment, together with the bomb load is mounted in a glider type air frame about 12 feet long, with a 10 foot wing span.

The preliminary design of a glider of 10-foot span was started in June, 1943, and construction of the first glider started approximately three months later. The Navy had placed a contract with Bell Telephone Laboratories for the design and development of a radar homing device early that year.

The first flight test of a 10-foot glider with radio control was made on May 10, 1944.

The "BAT" may be released from the mother plane at a range as great as 14 miles, and is automatically guided to the target by radar echoes.

MEASURES LIGHT OF FAINTEST STAR

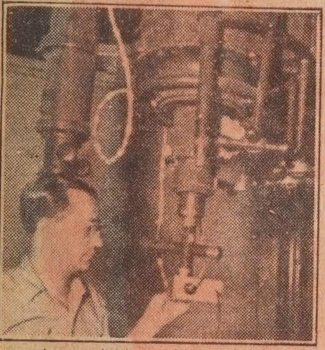
The amount of light reaching the earth from the faintest stars can now be accurately measured with a new form of photometer which incorporates two units developed by the Radio Corporation of America, the photo-multiplier tube and the Electronic Time Interval Counter.

DETAILS of the photometer, which was designed and constructed by William Blitzstein and I. M. Levitt, of the Flower Observatory and the Franklin Institute Laboratories, were revealed recently to the Astronomical Society in Evanston, Illinois.

In the Levitt-Blitzstein photometer, the image of the star is focused through a telescope on to a photosensitive element of the multiplier tube.

The light striking this element gives off pulses of electrons, which are then directed on to the first of a series of surfaces called dynodes, which generate secondary electrons. For every electron striking the first surface, two to five additional electrons are released.

With an accuracy of one millionth second, RCA electronic interval counters on table measure electron pulses generated by the faintest starlight.



A photo-multiplier tube is placed on the telescope where it receives the focused image of the star being observed.

By repeating these steps through the nine elements of the photomultiplier tube, the final product is a million or more electrons for each electron which left the first sensitive surface.

Previous methods used by astronomers for this purpose utilised a device called galvanometer, but the instrument is inherently unstable and reacts slowly to changes in the intensity of light pulses.

AUTOMATIC COUNT

The Counter makes the computation completely automatic. After setting a predetermined time interval on the device, the astronomer merely pushes a button, which exposes the counter to the output of the photomultiplier for the desired time, say 10 to 100 seconds, with an accuracy of 1-millionth of a second.

The number indicated on the counter at the end of this period is proportional to the light intensity of the star under observation.

RENDEZVOUS BY RADAR

A remarkable new system of refueling long-distance air liners in mid-flight has been developed by British South American Airways. Successful test flights have been made every week during this summer on the South Atlantic route, and it is intended to employ the new method on the North Atlantic route next year.

BOUND for Bermuda, the air liner has been leaving London carrying 7 tons less gasoline than needed for the non-stop trip. The 7 tons saved leaves room for an extra 7 tons of profitable freight. The basis of the whole system is an entirely novel application of radar aids. Here is how it is done.

That highly successful wartime radar setup, known as Rebecca-Eureka, was a radar beacon dropped with parachute troops and installed by them at the point required. It contained a transmitter, which emitted pulse-trains when triggered off by impulses sent out by Rebecca. In the war Rebecca was airborne and served to enable the aircraft carrying it to "home" on Eureka.

In the refueling system now being developed, a modified form of Eureka is also airborne, being carried both by the air liner and by the flying tanker from which it is refueled.

On leaving the London Airport, the air liner sets a course for the Azores, using the **Gee** radar navigational system for the first 300 miles and **Consol** or **Loran** after that, if weather conditions make position-fixing by direct methods impossible. The flying tanker is based on Santa Maria in the Azores.

The course of the liner having been plotted by radio and radar, a **rendezvous** is decided upon and radioed to the liner, the expected time of meeting being also given.

Each aircraft carries both Rebecca and Eureka. An hour before the predicted foregathering, each switches on Rebecca. They thus "home" on each other and always know each other's position, regardless of cloud or fog. In due time visual contact is made and the refueling begins.

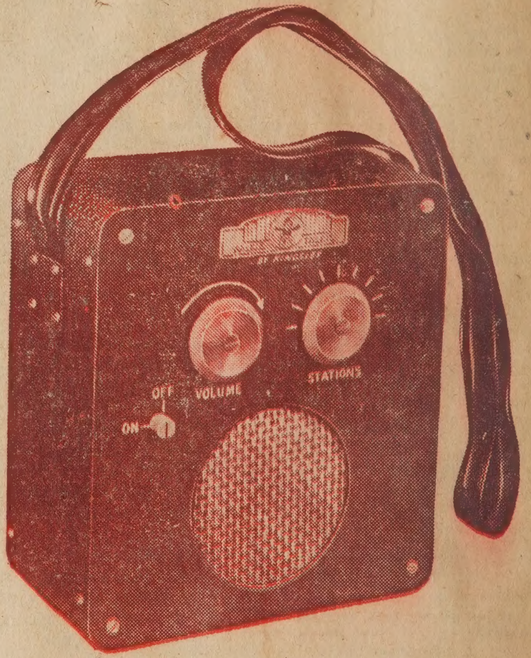
The first contact is always made with a weighted line trailed by the tanker, which must be a good conductor of electricity. Thus any potential difference between the two aircraft is wiped out, and there is no fire risk from sparks during the refueling.

Thanks to radio and radar, refueling in the air has been accomplished without the slightest hitch on every trip. The system has enormous possibilities, and may well be applied to much longer flights.

The right bank of a river is always the bank to the right of a person looking down stream, in the direction of the current.

Now you can build your "Walkie-Talkie!"

Kingsley "Ferrotuned" Foundation Kit



WALKIE TALKIE

by Kingsley

Kingsley is proud to present Australia's most outstanding Personal Portable Foundation Kit, just released from the Kingsley research laboratory! This amazing 4-valve midget is "ferrotuned"—an exclusive Kingsley feature!

Anyone can build the Kingsley "Walkie Talkie" from this simple-to assemble foundation kit. Compare its extra smartness, its smallness, and its amazing full-size mantel-model performance, and you'll appreciate its sheer superiority!

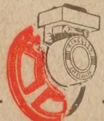
Foundation Kit comprises:—

- 1 type KFJB "Ferrotune" tuning unit (including coils, padders, etc.)
- 2 Kingsley miniature I.F. transformers, types KIF14 and KIF15.
- 2 tuning controls.
- 1 "on-off" switch.
- 1 carrying case (including back and front panels).
- 1 chassis with 4 sockets attached.
- 1 modern plastic carrying strap incorporating aerial.
- 1 battery holder.

Circuit, wiring instructions, and full parts list supplied with each foundation kit.

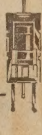
Miniature Speaker

Three inches in diameter, but designed to give a complete reproduction of all frequencies — big-speaker performance with amazing compactness!



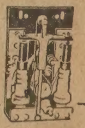
Miniature I.F. Transformers.

The best I.F. Kingsley have ever produced. These "babies" will give you all the gain in the world!



Miniature "Ferrotune" Unit

All the advantages of "Ferrotuning" packed into this splendid new midget unit-crystal clear tuning of every frequency!



Another Achievement by

Kingsley Radio

PTY. LTD., 380 ST. KILDA RD., MELBOURNE

Should your usual supplier be temporarily unable to supply you with a foundation kit—or any Kingsley Parts—drop us a line giving us his name and address.

SURGERY TELEVISED

Thousands of surgeons attending the New York Convention have witnessed operations by television in viewing rooms a mile from hospital.

FOR the first time in the long history of medicine, the skills of the best known surgeons have been closely observed by members of the medical profession at "clinics" remote from the hospital operating theatre.

This epoch-making demonstration was conducted during the recent Congress of the American College of Surgeons at the Waldorf-Astoria Hotel, when RCA television successfully linked the New York Hospital on East 68th-street, with viewing rooms a the hotel, a mile away.

ORTHICON USED

The experimental broadcasts were carried out as an indication of the possible applications of television to surgical education.

To make the demonstration possible, RCA Victor installed an Image Orthicon television camera on a specially constructed track above the operating table. This arrangement permitted the camera to be moved as required to obtain the best view of the operative procedure. The normal lighting of the operating-room was ample for the Image Orthicon camera. As the surgeons worked, their running commentaries were broadcast together with the images.

Pictures were transmitted from the hospital to the hotel by means of a high-directional television relay link. Because of the narrowness of the line-of-sight beam and the very high frequency used for the transmission, the programmes could not be picked up by standard television receivers.

Every move of the surgeon was picked up by the image orthicon camera suspended over the operating table. The signals were transmitted from a parabolic antenna to the identical unit, shown below, mounted on the roof of the Waldorf Astoria Hotel. Seven receivers installed on the fourth floor brought the scene to 300 viewers at once.

RELAYED

A cable carried the signals from the camera to the microwave radio relay transmitter on the roof of the hospital. From there, the antenna, which was shaped like a parabola, directed the signals to a similar receiving antenna on the 18th floor of the Waldorf-Astoria.

For the convenience of the surgeons, seven RCA Victor television receivers were installed in the Perroquet Suite on the fourth floor of the hotel. Seating facilities accommodated about 300 at a time. Two additional receivers were installed at the hospital. One was placed in the operating room to enable the operating surgeon to see the operative area covered by the camera; the other was in an adjoining office for the benefit of the hospital staff.

Operations selected for the television clinics included a hernia repair, a thyroidectomy, a gall bladder removal, and a stomach resection.

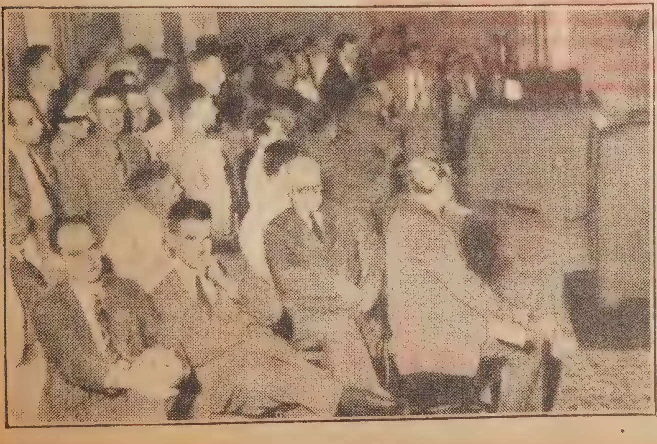
FOR TEACHING

After witnessing this contribution of electronic science to medical education, surgeons were lavish in their praise.

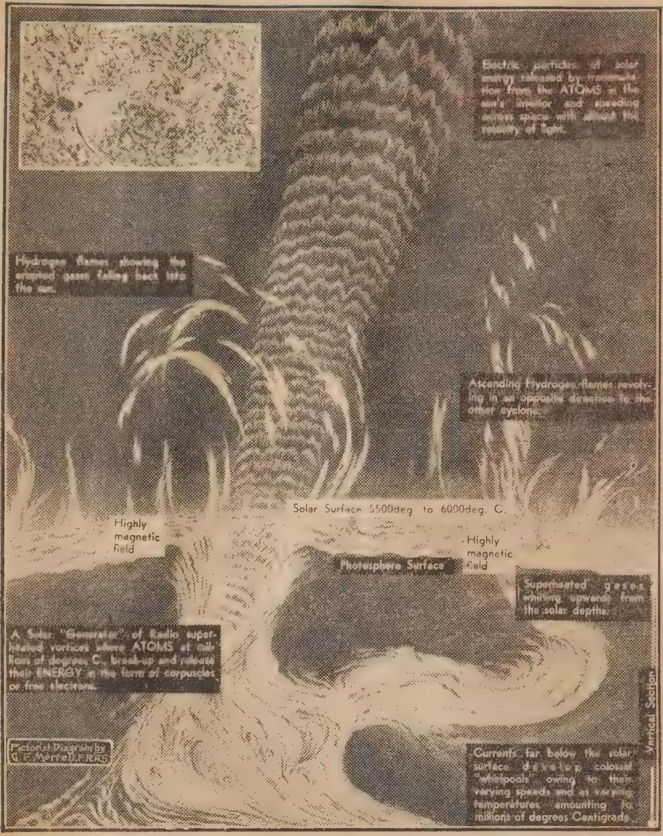
Dr. Arthur W. Allen, of Boston, president of the American College of Surgeons, said:—

"This is a teaching medium that surpasses anything we have had in the past. I never imagined that television could be so effective until I actually saw it demonstrated here."

Declaring that this use of television "greatly extends the teaching value of the hospital clinic," Dr. Malcolm T. MacEachern, Associate Director of the American College of Surgeons, said: "This is a wonderful development; we are enthusiastic over its potentialities."



LIGHT ANALYSIS BY THE SPECTRUM


Electric particles of solar energy released by transmutation from the ATOMS in the sun's interior and speeding across space with almost the velocity of light.
Hydrogen flames showing the erupted gases falling back into the sun.
Ascending Hydrogen flames revolving in an opposite direction to the other cyclone.
Solar Surface 5500deg to 6000deg. C.
Highly magnetic field
Highly magnetic field
Photosphere Surface
Superheated gases whirling upwards from the solar depths.
A Solar "Generator" of Radio superheated vortices where ATOMS at millions of degrees C. break-up and release their ENERGY in the form of corpuscles or free electrons.
Pictorial Diagram by G. F. Morrell F.R.A.S.
Vertical Section
Currents far below the solar surface develop colossal "whirlpools" owing to their varying speeds and at varying temperatures amounting to millions of degrees Centigrade.

One of the most fascinating branches of astronomy is the examination of the light from heavenly bodies by means of the spectroscope. With it the astronomer can tell us the composition of the stars. The manner in which the astronomer can analysise the stars and gain a knowledge of their composition is a mystery to most people, who nevertheless, accept it as a fact and consider that the study is too deep for them to even try to understand.

We know that it is obviously impossible for someone to go up there and take a sample of star dust. Neither does the scientiest search the earth for meteors to be analysed by a chemist, for even if this were done, it cannot be said that such an object originally, was a piece of Saturn or Mars or any other planet.

It is therefore obvious that an anaylsis must depend on only one of our senses which are available for the purpose, namely that of sight. This means, of course, that we must examine the light given off from the stars in order to gain the knowledge which we seek.

The study is not so involved that a simple explanation does not suffice to give the uninitiated a fairly good idea of how the problem is solved.

SIR ISAAC NEWTON

It all started back in 1666, when a Cambridge student about 32 years of age, made a momentous discovery. The student was Sir Isaac Newton. We have all heard of the gentleman, mainly through his experiences with an apple. This time he discovered that a beam of sunlight, when passed through a glass prism, was broken up into a band of colors. This was the now well-known spectrum and consists of seven main colors, namely violet, indigo, blue, green, yellow, orange and red.

This matter has been dealt with a number of times in these pages in connection with color and so forth, and readers are no doubt conversant with this part of the study. Nevertheless, as this is the basis of the matter, it is well to enlarge a little further.

"White" light, then, consists of a series of colored lights, which are now known to be caused by rays of varying wavelengths. When passed through the glass prism, the light rays are bent, and emerge from the prism at different angles according to the wavelength, thus falling into a band of colors which resemble the rainbow. In fact, if you can imagine cutting a slice from a rainbow, such a slice will be exactly the same as the spectrum of white sunlight, for this is just what a rainbow is—a spectrum of sunlight caused by the raindrops acting like prisms and splitting the sunlight up into its component colors.

When Newton made his epoch making discovery, he gave us the clue to the mystery of the stars, although this was not taken up for many years afterwards. He used a simple glass prism which gave a spectrum only a few inches in length. Later this was developed into a more efficient instrument where the light to be studied is passed through a tube on to the face of a glass prism. The light emerging through the prism is directed through a small telescope like a tube, which is pivoted. This tube can be moved from side to side, and enables any portion of the spectrum to be examined.

A remarkable drawing of the sun reconstructed from scientific evidence. In addition to light rays, the sun emits various radio waves particularly at a time of sun-spot activity as shown here. This illustration is interesting in view of the article on page 4 concerning the measurement of solar noise.

In 1821, a scientist named Fraunhofer, invented an ingenious contrivance for enlarging the spectrum. He engraved a mirror with many parallel fine lines. This made the mirror act like a prism, but caused the resulting spectrum to be much larger. In 1882, Professor Royland used a concave mirror which increased the size of the spectrum still further. These mirrors are called "diffraction gratings," and with

IS YARDSTICK TO SKY MYSTERIES

them, spectrums several yards long are obtained, which reveal a wealth of detail impossible with a simple glass prism. Colored lines which appear as single lines in the simple spectroscope are broken up into families of lines, and so provide an increased knowledge of the composition of light. The diffraction grating to the spectroscope is like comparing a simple magnifying glass with a microscope.

THE SPECTROSCOPE

Armed with this small amount of knowledge of the spectroscope, we are now in a position to learn how it is used in the study of the stars.

When it was found that sunlight could be broken up into its constituent colors, it was not long before scientists were examining all kinds of light with the spectroscope.

It is well known to chemists and students that when any chemical such as the compounds of sodium, potassium, lithium, calcium and so on, are heated in a flame, a characteristic colored light is given off. This property is often used to give a rough analysis of the compound. For instance, anyone who has heated a soldering iron in a gas flame has noticed the green color of the flame caused by the copper oxide on the iron. Likewise common salt or Sodium Chloride will give the brillian orange light characteristic of sodium, also seen in the brilliant sodium lamps used for lighting highways.

Potassium salts give a violet light, calcium produces red light, lithium gives us carmine, strontium crimson and so on.

CONTINUOUS SPECTRUM

When using ordinary white light, the spectrum is continuous in that there is no break between the colors, and it is impossible to discern where one color ends and another begins. This is called a "continuous spectrum," which term is of some importance, as will be seen later.

The light given off by various incandescent substances such as those listed above shows, when examined by the spectroscope, not a continuous spectrum, but a spectrum of bright lines which are colored according to their position in the spectrum. The light from sodium salts, for instance, give one single yellow line. Lithium gives a red and an orange line and the other compounds give colored lines each in a particular position in the spectrum.

Every element known to science has thus been examined spectroscopically, and these results have been charted so conclusively that it is possible to determine the composition of many substances by heating them and examining the light in this manner. For instance, if, when examining a spectrum, a yellow line is seen in a particular position, we know we are dealing with sodium, and likewise through all the other elements.

by Calvin Walters

STAR COMPOSITION

Readers have probably now begun to see how this method is used to determine the composition of stars. All that is required is a diffraction grating and a chart of the spectrum of the various elements. Comparison of the light from the star focussed through a telescope on to the grating with the charts will reveal the elements present in the stars from which the light is transmitted.

But, of course, that is not all the story. It has been found that the spectrum is influenced by the nature of the body from which the light is emitted. Light from an incandescent solid or liquid passed through a prism will give a spectrum of continuous colors characteristic of its elements.

ABSORPTION LINES

On the other hand, if the light on its way to the prism passes through a gas at a lower temperature, this gas "absorbs" the lines characteristic of the element, and a corresponding dark line appears in the spectrum. This is called the "absorption spectrum" and the various kinds of spectrums constitute the secret to the analysis of the light.

These dark "absorption lines" were first discovered by a Dr. Wollaston at the beginning of the 19th century, but they were mapped out by the Bavarian optician Fraunhofer, and were accordingly called "Fraunhofer lines." They were first discovered in the spectrum of the sun, and Fraunhofer in his charts named them with letters of the alphabet.

The appearance of these dark lines in the spectrum of the sun was a mystery for some time until it was discovered that a gas of any element at a lower temperature than the element itself will absorb the spectrum color and a dark line will appear in the spectrum where a colored line should have been.

This discovery was of very great importance, for it follows that if we obtain a spectrum with a series of dark lines in it, and we find a metal whose spectrum has corresponding bright lines in it, we may safely assume that the dark lines are produced by that metal.

This may be more simply explained as follows. If we heat a strontium salt to incandescence, we will obtain a spectrum with a red and an orange line in certain positions. If now we interpose between the heated strontium and the prism, a flask containing a strontium gas, dark lines will immediately appear in the spectrum where the colored lines were. The gas has absorbed the colored lines.

DARK LINES

Thus by comparing known standard spectrums with the spectrums of the light from the various stars, it can be estimated with almost a certainty, the elements which exist in the body emitting the light.

When the dark lines were first discovered in the spectrum of the sun there was much speculation. It was thought that they could originate

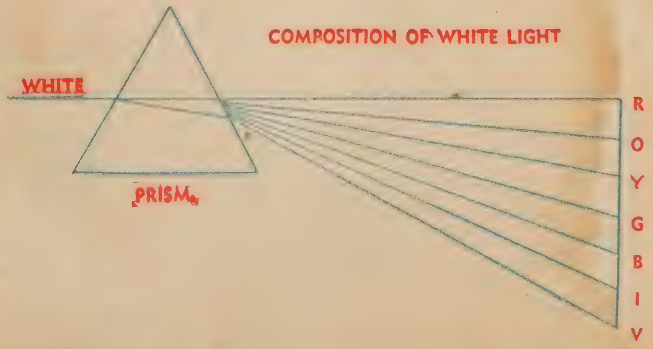
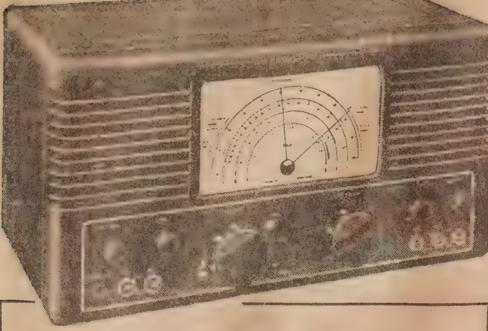


Diagram of a prism showing the way it splits white light into the colors of the spectrum,



This is it! the "640"

ACCLAIMED EVERYWHERE AS THE FINEST "HAM" SET YET DESIGNED

Eddystone Amateur Bands Communications Receiver Model 640

MAIN TECHNICAL FEATURES

1. Receiver has been designed primarily for Amateur Communication purposes, tuning range from 31 Mc/s to 1.7 Mc/s.
2. Designed to operate from Standard AC Mains with Inputs of 110 volts 200/240 volts, 40/60 cycles as well as from a 6 volt battery by the use of a separate vibrator unit.
3. Inclusive all valves, the "640" is a 9-valve job with one tuned RF stage, FC, two IF stages, detector-AVC-1st audio, 2nd audio output, noise limiter, BFO and rectifier. The valves used, in that order are EF39, 6K8, EF39, EF39, 6Q7, 6V6, EB34, EB39 and 6X5. These are all international octal based on the Mullard or Brimar versions and are therefore easily replaceable.
4. INPUT IMPEDANCE—400 ohms.
5. TUNING RANGE—
   (1) 31 to 12.5 Mc/s.
   (2) 12.5 to 5 Mc/s.
   (3) 5 to 1.7 Mc/s.
6. TUNING. An electrical band-spread arrangement is used for this purpose. Fly-wheel control is utilised on the band-spread condenser drive. The scale is clearly marked with all amateur bands, and is so arranged to enable accurate re-setting to a spot frequency.
7. I.F. FREQUENCY—1600Kc/s.
8. CRYSTAL FILTER is vacuum mounted to provide a high degree of stability. Phasing control and "in/out" switch are brought out to the front panel.
9. Sensitivity is better than 2 microvolts input, for 50 milliwatts output, at all frequencies.
10. OUTPUT. Audio frequency output exceeds 3.5 watts.
11. "S" METER. A socket is provided for an external "S" Meter.

● READ THESE TRIBUTES . . . . FROM THE "G's" OVERSEAS

● "Your claims are fully justified, the performance being excellent in every way. The outstanding feature is of course the Wonderful signal to noise ratio, and this, together with its excellent sensitivity, should satisfy the most confirmed critic.

On the 10 metre band I have compared received signals using the "640" and a 3 element beam, with the same received signal at other stations using 3 element beams, time and time again (hence the delay in sending my report), and I have proved to my satisfaction that the "640" has the advantage, taking an average over a large number of contacts, which practical report you will probably appreciate more than most laboratory reports. The excellent signal to noise ratio of the "640" has enabled me to carry through a QSO which, with my previous Station receiver, would not have been completed, under similar conditions. I have spent quite a lot of time on these comparative checks, and have proved these points conclusively.

The noise limiter is extremely effective, as is the crystal filter. In clusion, I state that the "640" is a really fine job, which fills a long felt want for a standard British Amateur Communications Receiver, which will have my hearty support, and I hope that this is the first of a new series of Amateur instruments by Eddystone.
I might add that the "640" is now my own station receiver, and I'm rather fussy."

● "It proves it to be a most remarkable receiver and you are to be congratulated on producing such an outstanding 'Ham' set, and we wish you every success in this market."

● "Having fully tested the model "640", it fully comes up to the standards required for a Communications receiver of this nature, especially on the 'Ham' bands, we were able to separate stations working almost on top of each other.

"The signal to noise ratio is extremely good. We have great hopes for this set during the coming season. You are to be warmly congratulated on the production of a very fine model."

● "The "640" was tried out over the week-end by our Mr. W. and J.B., an ex-Merchant Navy Radio Officer of some ten years operational experience. The latter was delighted with the sharp and clear C.W. note obtained by this receiver. We compared general sensitivity, selectivity and ease of control with two highly rated USA RX. "640" compared more than favorably with either model. Noise level for a given signal in fact, was much lower in either case and the measured carriers of very weak signals were in several instances slightly superior on the "640." The appearance is really a fine job and, altogether, we feel that if this set was exported even to the USA, it would readily find enthusiasts who still believe we in Britain can produce the goods without a lot of unnecessary trimmings and yet efficient and exacting standards."

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in two ways. It was possible that they were absent from the sunlight altogether or they may have been absorbed as they passed through some substance on their way to the earth. Some of the lines were found to be due to absorption by the atmosphere of the earth and are most prominent when the sun is low in the sky. These lines are called "telluric" lines.

These "telluric" lines have, in the course of time, become recognised and are disregarded in the final analysis, so that confusion is no longer possible.

If lines should appear in the spectrum of heavenly bodies that have not been seen before, it is certain that some new element is the cause of it. The discovery of Thallium is a case in point, although this was not discovered by an analysis of star light. It was discovered by a Mr. Crookes, in 1861, when he was examining spectroscopically, the deposit in a lead chamber of a sulphuric acid factory in the Harz Mountains. The light from the deposit was an intense green, which had not been observed before in the spectrum. This discovery lead to a search, and the metal, Thallium, was soon discovered in large quantities.

HELIUM

Of more particular interest is the discovery of the element helium. The position of most of the dark lines in the solar spectrum coincides with those of substances known on the earth. But, in 1868, a line was discovered which could not be identified with any substance known. It was assumed that an element existed in the sun which was not known to us, and it was called Helium after the Greek word "helios," meaning Sun. This gas was later, in 1895, discovered during the investigation of radium. It was found that radium gave off this gas which was identified in the sun by comparison of the two spectrums.

Another remarkable fact learned by spectroscopic analysis is that the character of the spectrum of any substance will change in temperature or pressure. A gas which is highly compressed will give broader lines in the spectrum as the pressure is raised and the lines thin down as the pressure is decreased.

It will readily be seen that this fact is of very great importance in astronomy, for it enables the astronomer to give a fairly safe assumption of the state of a particular star. By the appearance of the various dark bands it can be determined whether the star is one with a highly compressed nucleus, whether it is gaseous, whether it is very hot and so on.

An interesting and remarkable application of spectrum analysis is the measurement of the rate at which a heavenly body is approaching or receding. As light waves are of definite wavelength, it follows that if we are relatively steady with regard to the star being observed, the spectrum will remain constant. Let us assume, however, that an observed star suddenly begins to approach us. The waves of light will then begin to reach us at a faster rate and will therefore, appear shorter.

This will have the effect of moving the lines of the spectrum towards the short wave or violet end. If, on the other hand, the star begins to move away from us (a condition much less alarming than the former), the waves of light will take longer to reach us and will appear longer. The lines will then move towards the longer wavelength end of the spectrum, namely the red end. Should the lines move right off the violet end, it denotes that it is time to pack up and get away somewhere if you have the chance.

SIRIUS SPECTRUM

In the spectrum of Sirius, one line is shifted very slightly towards the red end. This small amount has been measured and it has been determined that Sirius is running away from us (and I don't blame it under present conditions) at a speed of about 20 miles a second. (Oh, how he must hate us). On the other hand, another one is so anxious to join hands that he is approaching us at the rate of 55 miles per second. This is Arcturus, and it is hoped that he is still a long way off.

NEWTON'S WORK

Thus, from the simple discovery by Sir Isaac Newton of the spectrum of white light, has grown a science of inestimable value to man, for not only has he been able to learn more of the mysteries of the heavens, but he has also been given an outstanding aid to chemical analysis. The spectroscope has become a valuable instrument in crime detection, for the examination of blood stains, etc., and in the science of medicine it has enabled the scientist to discover more efficient drugs and chemicals for the healing of the sick.

A WEATHER "BUBBLE GUM"

Not a giant "bubble-gum," but a large meteorological balloon. We suggest that the lady had some help in its inflation!

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VEALS Offer you the Ultimate in POSTWAR TEST EQUIPMENT . . .

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Enjoy the thrill, the satisfaction of building your own Oscillator . . . with the **UNIVERSITY Model OK1 Oscillator Kit !**

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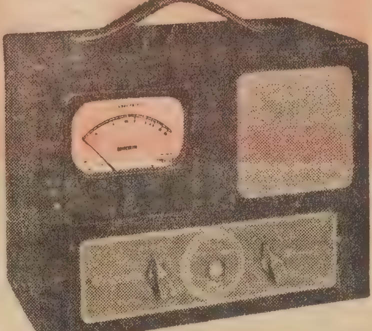
Takes the guess work from Radio Servicing . . .



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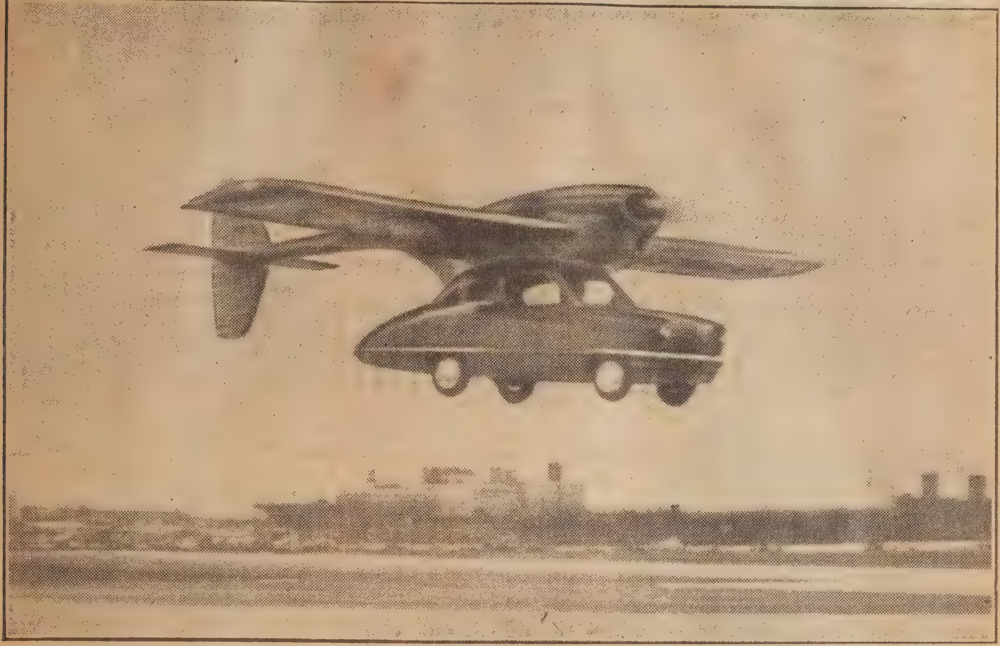
CAR AND MOTOR CYCLE TAKE THE AIR



NEW IDEAS FROM U.S.A.

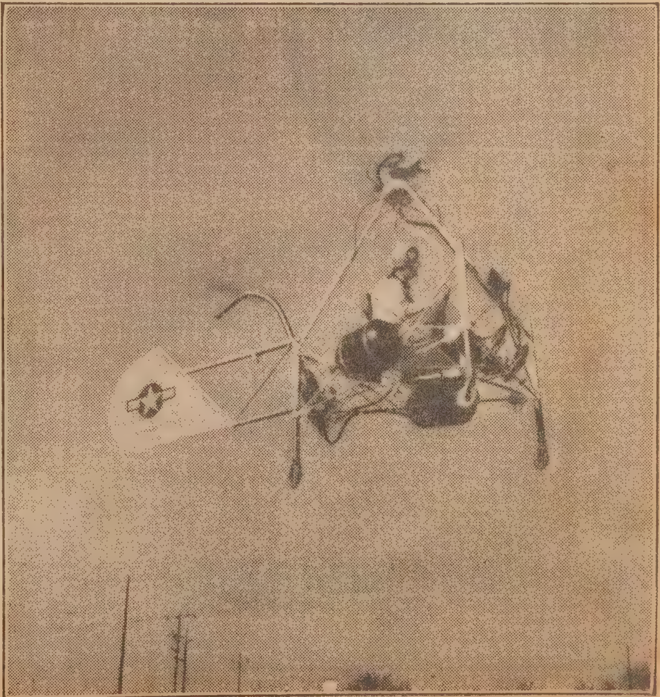
Making things fly is part and parcel of our present age. All over the world, men are working out ideas for the ultimate amphibious vehicle which to date has not appeared in sight. The task of building something for the average man which will swim, run and fly isn't altogether easy.

THESE two machines are interesting from many angles, although both are definitely experimental.

The first is a flying motor car, made by Consolidated Vultee in USA. It comprises a four seater car of conventional type to which is attached an aircraft fuselage. The aircraft section has its own engine so that it is in effect, a detachable unit to fly the car from place to place.

Apparently the idea is workable, as the strange combination circled round San Diego for nearly an hour and a half last November.

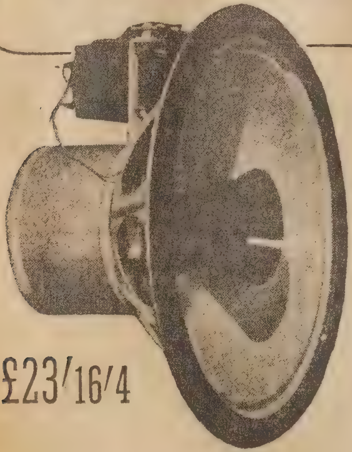
The fearsome looking object at the right is a helicopter motor cycle of the US Army. The rotor blades are driven by ram jets. Although the cycle weighs only 310lbs. it has lifted an additional load of 300lbs. Its top speed is about 50 miles per hour. Its use in present form is probably not so important as the possibilities it may hold.



They've arrived!

HIGH FIDELITY
LOW PRICED **PHILIPS**

IMPORTED LOUDSPEAKERS



12", HIGH FIDELITY, LOUDSPEAKER TYPE 9801

This new-type, 25-watt, moving-coil speaker gives beautifully clear tone, high-powered reproduction with remarkable sensitivity (105 phons). This has been made possible by means of a special steel and copper magnet construction which ensures that the impedance characteristic acquires a very much flatter trend. Uniform diffusion of sound, especially at high frequencies, is assured by means of the famous "Philite" Sound Diffuser.

Max. handling capacity on continuous load . . . 25 watts. Max. voltage on Transformer . . . 100 volts. Max. voltage on speech coil . . . 31.6 volts. Impedance of Transformer at 1000 cycles . . . 400 ohms. Impedance of speech coil at 1000 cycles . . . 40 ohms. Max. sound level, 435 cycles . . . 105 phons. Field strength . . . 1000 lines/CM^2. Resonant frequency . . . 68 cycles.

£23/16/4

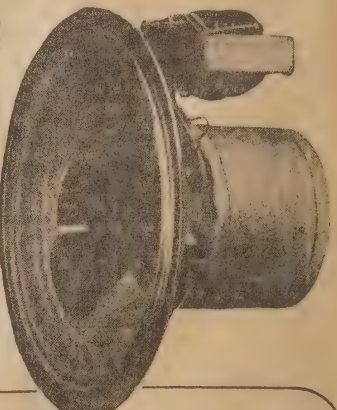
£14/4/8

10½", HIGH FIDELITY, LOUDSPEAKER TYPE 9807

This 10-watt speaker has an exceptionally high sensitivity (103 phons). As a result of its steel and copper construction, it gives remarkably good production of high notes, whilst the outside centering spider of the speech-coil ensures that low notes are faithfully reproduced. This loudspeaker is also fitted with the famous "Philite" Sound Diffuser.

Max. handling capacity on continuous load . . . 10 watts. Max. input voltage with transformer . . 100 volts. Max. input voltage of speech coil . . . 20 volts. Impedance of Transformer at 1,000 cycles . . . 1,000 ohms. Impedance of speech coil at 1,000 cycles . . . 40 ohms. Acoustical output at 435 cycles . . . 103 phons. Field strength . . . 10,000 gauss. Resonant Frequency . . . 55 cycles

These units are available now from your nearest Philips Office.



PHILIPS LOUDSPEAKERS

PHILIPS ELECTRICAL INDUSTRIES OF AUSTRALIA PTY. LTD: Sydney, Melbourne, Brisbane, Adelaide, Perth

518-47

MOVING PICTURE CARTOON DISPLAY

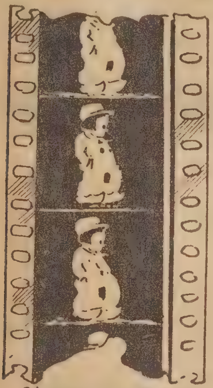
As can be seen, the "heart" of the device is located in a blacked-out room behind the visible display.

Special cartoon films, drawn in tiny squares, are projected by a cinematograph on to a frame 3ft. square, which is a mosaic studded with photo-electric cells.

According to the detail on the piece of film in front of the lens, so certain of the cells are in bright light, others remaining in darkness. Each photo-electric cell affected by the beam of light transmits a small electric impulse through its own individual circuit.

Each photo-electric cell in the frame is directly connected to a relay valve in yet another frame. From every single relay valve the circuit is linked up with the corresponding electric lamp on the sign outside.

With individual pictures projected at 16 a second, the lamps on the sign flash on and off at the same speed, faithfully reproducing the scenes of the film strip.

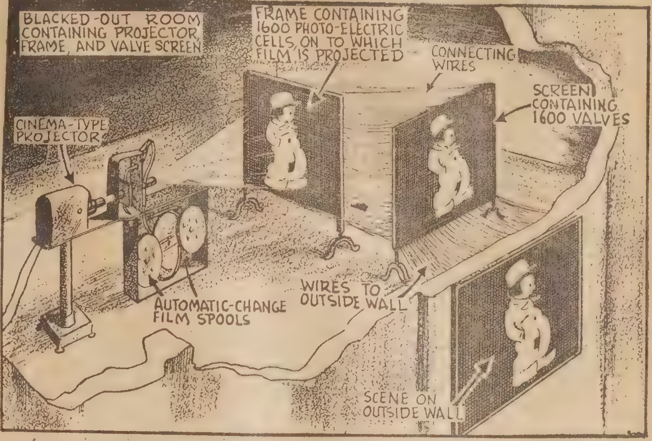


SAMPLE SEQUENCE FROM TYPE OF FILM USED.

For the projection of these giant cartoons, 1600 gas-filled photo-electric cells are needed, together with 1600 valves to relay the impulses and 1600 electric lamps for the outside wall sign itself.

The projection room is in complete darkness, for the photo-electric cells must receive only the light intended for them. If, for instance, the projector were turned off and the beam of an electric torch were shone on to one photo-electric cell, people watching from the street would see just one lamp light up. If the torch were waved over the frame of cells, the movement of the beam would be copied on the sign.

In actual practice, the beam of light from the whirring projector shines on the maze of cells. Again, from the big panel of relay valves, comes a "light echo."


BLACKED-OUT ROOM CONTAINING PROJECTOR FRAME, AND VALVE SCREEN
FRAME CONTAINING 1600 PHOTO-ELECTRIC CELLS, ON TO WHICH FILM IS PROJECTED
CONNECTING WIRES
SCREEN CONTAINING 1600 VALVES
CINEMA-TYPE PROJECTOR
WIRES TO OUTSIDE WALL
AUTOMATIC-CHANGE FILM SPOOLS
SCENE ON OUTSIDE WALL

One of the most ingenious types of "animated" advertising signs is the moving picture display used in London and New York, the working of which can be followed from the diagram-sketch here. Using hundreds of lamps for the display sign—1600 in the case of London's most famous example—and a corresponding number of photo-electric cells, the device is notable for the simplicity of its working, since it is automatic in its operation.

The spools of the projector, holding an endless band of about 300ft. of film, are so arranged that one spool feeds the film to the projector and another reels it in. As the show nears its end, the weight of the full spool tips the empty one into position for the next run through.

The whole display lasts for about six minutes, during which time four complete films are projected. Then it begins all over again.

Above the moving street display, a bright neon sign displays the advertiser's name. There are four advertisers to a show, and this means four separate neon signs, which are changed automatically as the film reels through the projector.

SORTING METAL BY ELECTRONICS

DEVELOPMENT of an electronic device, which can distinguish between different metals, and different grades of the same metal, is announced by engineers of GE's General Engineering and Consulting Laboratory. It employs an electronic circuit to discriminate between metals being tested, and is not fooled by paint, polish, or rust.

D. E. Bovey, G-E engineer, who directed work on the device, sees the metals comparator as useful for inspecting parts in quality control on production lines, and for sorting rapidly and without damage supplies of metal objects, such as rods, pipes, nuts, bolts, and others, in stock rooms.

Operating on the principle that metals having chemical or physical differences also have electrical and magnetic differences, the metals comparator simply presents on the face of an instrument a reading which shows how closely a particular specimen compares with the standard, according to Mr. Bovey.

The equipment consists of a metal box, about the size of a table-model radio, which contains an audio-frequency oscillator, having 10 different frequencies, ranging from 50 to 10,000 cycles. The box also contains control devices and a scale which is capable of being read even by an unskilled operator.

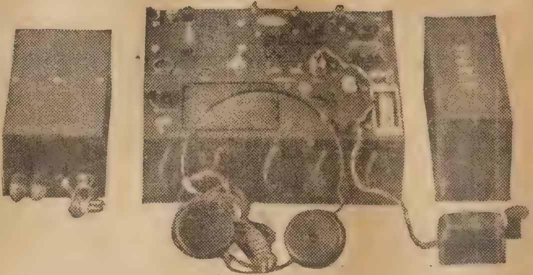
Attached to the box by a cord is a hollow coil of wire. Into this coil the operator places a metal object of known characteristics. The operator then "balances" the equipment so that the indicator on the scale points vertically to zero. Similar objects of uncertain characteristics then are tested, and those not identical chemically or physically to the standard, will cause the indicator to swing to the right or left of the zero mark.

Type A Mk. III SUITCASE PORTABLE TRANSCEIVERS

FEATURES:

- Set of instructions.
- Overall dimensions—9 x 7½ x 3 inches.
- 6v Vibrator Power Supply.
- 5 Loctal-based Valves.
- Crystal Controlled.
- Freq. Range 3 to 9 mcs.
- Superhet. Receiver.
- Complete Set of Spare parts, including Valves and Vibrator, etc.

PRICE £9/19/6 F.O.R.



All this plus Two Portable Carrying Cases (All Black Crackle Finish)

IDENTIFICATION LAMPS ex-R.A.A.F.

4½in. diameter—chrome reflector—black plastic case. Complete with lamp holder of standard car size.

Supplied with clear, amber or green glass.

Price 8/6 each

Additional glasses 1/6 each.

Packing and postage 1/- extra.

Vibrator Power Supply complete with filter, 12v input, 300v output at 150 M.A. Also supplied with two 6X5GT rectifiers and one Ferrocart Vibrator cartridge.
F.O.R. EACH £3/10/-

GENEMOTORS

No. 11. 12v. input, 210v. output at 50M/A. With Filter.	30/-
No. 11. 12v. input, 340v output at 40 MAS	25/-
12v. input, 1000v output at 200MAS	130/-
26v input, 250v output at 100 MAS	35/-
26v input, 550v output at 350 MAS	90/-
28v input, 250v output at 60 MAS	25/-
28v input, 575v output at 160 MAS	50/-
No. 19. 12v input, 250v output at 110 MAS and 500v output AT 50 MAS, complete with Filter.	50/-

CHOKES

175 M.A.—15H	20/-
100 M.A.—10H	8/6
100 M.A.—15H	10/-

240V. 50 C.P.S.

TRANSFORMERS

Secondary 425v CT. 425v 100 M.A. 5v 2 amps	25/-
Secondary 6.3v CT. 3 amps	12/6
Secondary 6.3v 4A. 6.7v 4A, 6.7v 4A.	20/-
Secondary 8.5v 8A 8.5v 8A	30/-
Secondary 10v 10A 10v 10A	35/-

PAPER CONDENSERS

0.1 mfds., 2000 V.W.	2/-
0.25 mfds., 3000 V.W.	6/-
1.00 mfd., 1000 V.W.	4/-
2.00 mfd., 500 V.W.	4/-
4.00 mfd., 750 V.W.	8/6
4.00 mfd., 2000 V.W.	20/-
5.00 mfd., 400 V.W.	5/-
8.00 mfd., 400 V.W.	6/6
10.00 mfd., 450 V.W.	8/6
15.00 mfd., 500 V.W.	8/6
80 mfd., 250 V.W.	20/-
200 mfd., 100 V.D.C.W.	4/-
500 mfd., 100 V.D.C.W.	7/6
1000 mfd., 12 V.D.C.W.	4/-
2,000 mfd., 12 V.D.C.W.	5/-

ELECTRONIC EQUIPMENT Co.

29b WEST STREET, LEWISHAM, SYDNEY — TEL. LM3555

NEWS AND VIEWS OF THE MONTH

Sound That Kills

ONE of the month's most interesting items concerns the development by the US Army of a sound machine which kills.

The machine is capable of producing sounds of an extremely high pitch, much higher than the human ear can detect. These sound vibrations, when projected with sufficient power, have already killed mice, boiled water, and burned operators.

Sound is the name generally given to air vibrations, because many of them are audible. It is obvious, however, that the air can be made to vibrate at frequencies much higher than about 15,000 cycles, which is the limit of average hearing. Some animals can hear sounds much higher than this frequency.

We are familiar with the effects of high frequency radio heating, by which materials may be heated when placed within a suitable radio field. What happens in such cases is that the radio energy generated by the oscillator is transmitted to the object to be heated by vibrations set up in the ether. In other words, there is a transference of energy through a medium from one point to another.

This is exactly what happens in the case of these ultra-sonic sound experiments, except that the vibrations are much lower in frequency than are radio vibrations, and the transmitting medium is air, and not the ether.

Heat And Friction

RECEPTION by a body of this sound energy causes it to vibrate at the same rate as the sound. This vibration sets up internal friction in that section of the body which is actually vibrating, with the resultant generation of heat. It is this heat which apparently does the damage.

There may, of course, be other effects which would take place if the power were sufficient, including actual disruption of the body itself.

Various estimates have been made on the use of the idea for generating a "death ray" and so on. The main factor to be considered here is the rapid attenuation of the sound power with distance. Even if the original power were very high, and concentrated into a narrow beam, as it would need to be to bring it under control, fantastic sound pressures would be required to make it effective over anything but short distances. The same is true, of course, if radio waves were used. The enormous power needed to cover all but short distances has always been a big obstacle to such things.

The sound experiments are, therefore, more interesting for their scientific value, and application in the industrial field, than as a source of death-dealing. The potential is there, but physical limitations are against it.

New Microtubes

THE wrist watch radio of Dick Tracy and other fictional supermen may become a reality if radio continues at its present rate.

In the latest issue of "Radiocraft," details are given of new radio valves not much bigger than grains of rice.

So far, the valves are in the development stage only in the laboratory of a big manufacturer, who is producing them under contract, presumably for defence projects.

Valves have always been the key components in all electronic devices, the design of which centres round them. Many machines in industry and other fields require huge numbers of valves, often running into thousands. With the growing use

RADIO CROSSWORD PUZZLE NO. 5

ACROSS

1.—Compensation radiation.
7.—Valve elements.
9.—Type of code.
10.—Greek symbol for efficiency.
11.—Insulating material.
12.—Record.
13.—Heed.
16.—Type of converter.
18.—Not wanted in most valves.
20.—Peer.
21.—Conductor size unit.
22.—Type of current.

DOWN

2.—Valve element.
3.—Resonance characteristic dip.
4.—Type of dial.
5.—Telephone receiver.
6.—Ability to separate stations.
8.—. . . . down transformer.
9.—Unit of conductivity.
12.—Measurement of gain.
14.—Style of dial.
15.—Type of antenna.
17.—Conductor.
19.—Eating utensil.

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BELOW: LAST MONTH'S SOLUTION

C	■	I	■	O	N	D	O	M	E	T	E	R
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U	■	E	■	D	■	A	L	I	G	N	■	D
S	O	S	■	E	■	L	■	■	Y	O	G	I
C	■	S	■	S	U	P	E	R	■	V	■	F
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D	E	C	R	E	M	E	N	T	■	E	■	N

COMPLETE KIT SETS AVAILABLE

Of All "R & H" Circuits

T.R.F. MAJESTIC RADIOGRAM

ALL PARTS INCLUDING SPEAKER **£18/1/5** VALVES EXTRA **£7/3/10**
PACKED AND POSTED FREE.

6-240 MANTEL SET

ALL PARTS INCLUDING SPEAKER AND VIBRATOR **£13/4/3** VALVES EXTRA **£5/2/5**
PACKED AND POSTED FREE.

HANDI-TALKIE PERSONAL PORTABLE

ALL PARTS INCLUDING SPEAKER AND CABINET **£9/7/7** VALVES EXTRA **£5/12/2**
PACKED AND POSTED FREE.

20-WATT AMPLIFIER

ALL PARTS INCLUDING SPEAKER **£10/15/3** VALVES EXTRA **£4/8/11**
PACKED AND POSTED FREE.

1947 ADVANCE, 5-VALVE

ALL PARTS INCLUDING SPEAKER **£14/1/2** VALVES EXTRA **£4/12/11**
PACKED AND POSTED FREE.

TOM THUMB AUSTRALIA'S SMALLEST RECEIVER

ALL PARTS INCLUDING HEADPHONES CABINET AND BATTERIES **£6/13/5** VALVES EXTRA **£2/5/2**
PACKED AND POSTED FREE.

LITTLE GENERAL 4 VALVE

ALL PARTS INCLUDING SPEAKER AND CABINET **£10/9/3** VALVES EXTRA **£4/0/10**
PACKED AND POSTED FREE.

LITTLE JIM 2 BATTERY VERSION

ALL PARTS INCLUDING HEADPHONES AND CABINET **£5/3/10** VALVES EXTRA **18/10**
PACKED AND POSTED FREE.

Please write for quotations for any parts list or kit set required. Prompt return of mail service. Free technical advise to purchasers of kit sets. Sets checked, lined and rewired. Nominal charges.

SPRAY GUNS

Just the thing for the handy man—works off vacuum cleaner—complete with fine and coarse spraying nipples. Complete with full instructions—lots of use for one of these around the house and workshop.

10/6 EA.
POSTAGE 1/6

SOLDERING IRONS

THE FINEST SOLDERING IRON YET OFFERED SHAPED HANDLE PLATED BODY GUARANTEED 12 MONTHS YOU WILL NOT BE ABLE TO FAULT THIS IRON. FLEX EXTRA.

		Spare Bits	Spare Elements
40 watts,	23/10	1/11	8/6
75 watts,	23/10	2/6	8/6
90 watts,	28/2	2/11	8/6
125 watts,	52/6	6/6	14/6
150 watts,	63/11	11/6	16/6
200 watts,	84/6	16/6	22/6

Postage, 1/3. 40-90 watt, 2/-. 125-200 watt irons, postage 6d. Spare elements and small bits, 1/- large bits.

SOLDERING SUNDRIES

RESIN CORE SOLDER
2oz. card, 1/-. Postage, 6d.
1lb. reel, 4/11. Postage, 1/3.

RIBBON SOLDER
1/- doz. strips 14in. long. Postage, 4½d.

CORALINE SOLDERING PASTE
2oz. tin, 1/-. Postage, 4½d.
4oz. tin, 1/11.

TINNED COPPER WIRE BUS BAR
16-18-20-22 Gauge
1lb. reels, only 4/6lb.
Postage, 1/3.

NYLEX TUBING (Spaghetti) 3d. yd.

ENAMELLED AND COTTON COV'D WIRE

¼lb. reels, Only Available. Postage, 8½d.

- 24 G. Cotton covered, 2/3 reel
- 25 G. Cotton covered, 2/3 reel
- 24 G. Enamel covered, 2/3 reel
- 25 G. Enamel covered, 2/3 reel
- 27 G. Enamel covered, 2/6 reel
- 28 G. Enamel covered, 2/6 reel
- 36 G. Enamel covered, 3/- reel

"NEWCASTLE'S LEADING RADIO & ELECTRICAL STORE."

Address Telegrams
"Stanradio"
Newcastle

A deposit must be forwarded with all C.O.D. orders.

NEW STANDARD RADIO

102 HUNTER ST. NEWCASTLE

Phone B3465
Newcastle

Please include postage. A Cash refund will be made for any excess cash forwarded with your order.

of other tiny components, the valves have often been by far the largest things in the equipment.

The use of these tiny valves will revolutionise such devices. Produced in quantity, they could well become just as easy to install as resistors or condensers. Their expected life is 15,000 to 20,000 hours—their replacement, therefore, would be comparable to that of many other parts. When defective, they would merely be removed and replaced on a similar basis. Sockets would probably be unnecessary, the valves being wired directly into the circuit.

Hugo Gernsback makes an interesting suggestion for powering these valves in a practicable wrist-watch radio. He visualises a tiny generator powered from a watch spring, which is wound up as often as necessary while receiving, possibly every few minutes. As such a radio would be a "special," this wouldn't be objectionable, and would solve the battery problem.

The use of these small valves in handie-talkies and other small equipment calling for many valves is, of course, easy to visualise.

The editorial in this issue refers to wartime developments which so far have not found their way into the domestic radio field. These new valves are one such development, for radio valve manufacture, and small valves in particular, was tremendously accelerated during the war years for such things as the proximity fuse—a complete radio equipment built into the nose of a shell.

We expect big things from these new microtubes.

V.H.F. Records

MOST interesting news of the month from our point of view is the establishment of a 50 mc. circuit from VK2JU, located on the top of our building in Sydney, and VK2TA-VK2TC, located near Young, NSW, a distance of over 180 miles.

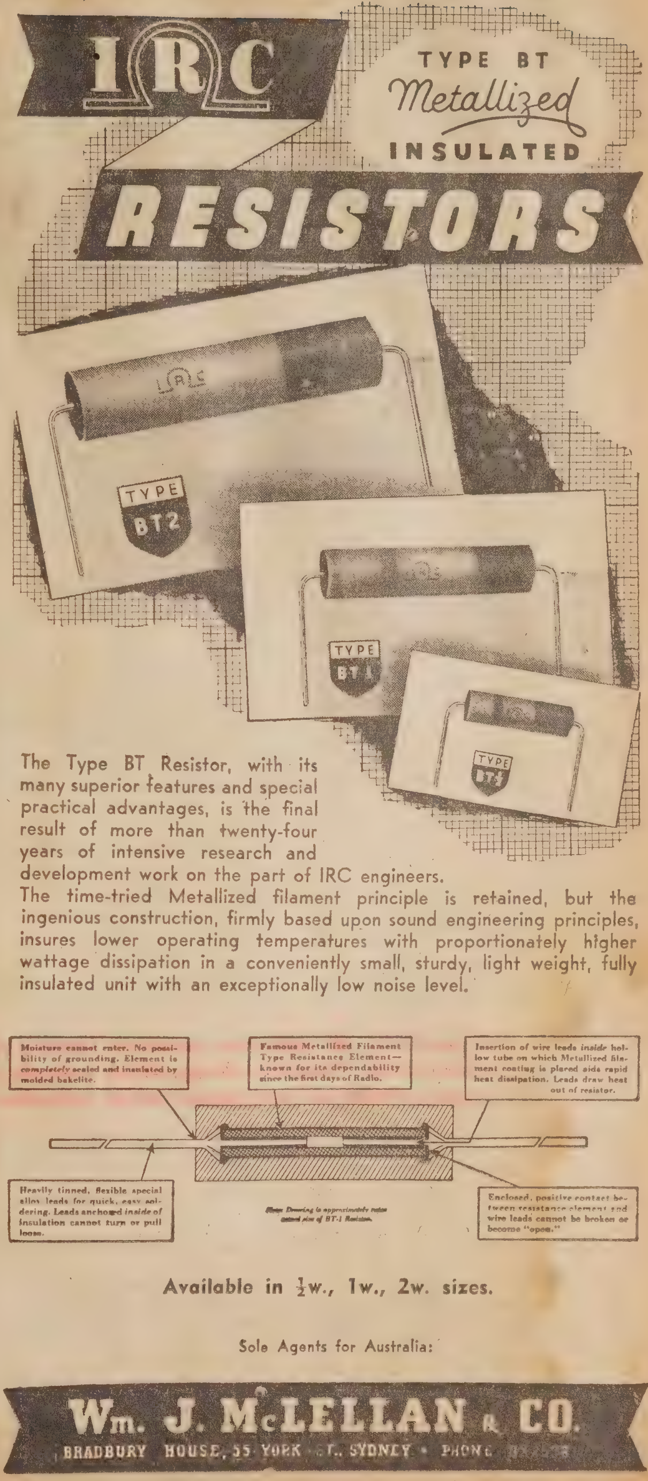
The first contact made some weeks ago resulted in signals from 2JU up to S9 in strength on phone, and a CW S5 signal back from VK2TA, who was using very much lower power.

Since that date, every schedule kept has resulted in a cross band contact either with 2TA or 2TC, who are separated by about seven miles, using 50 mc. from this end and 7 mc. from Young.

The transmitter at 2JU is the push-pull job described in the Australian Radio Handbook, but using 812's instead of 809's. The converter is the three-valve job also described, while 2TA used the 807 50 mc. transmitter included in the same publication.

Contacts are now being made from 2JU with Newcastle and Cessnock, Wyong and Gosford, all of whom hear signals at full strength. The signals have also been heard by 2NP in Tumut and 2GU in Canberra.

This is the first occasion that regular signals have been heard inland, the 2TA contact probably being an Australian record to date.



IRC

TYPE BT
Metallized
INSULATED
RESISTORS

IRC
TYPE BT2
TYPE BT1
TYPE BT½

The Type BT Resistor, with its many superior features and special practical advantages, is the final result of more than twenty-four years of intensive research and development work on the part of IRC engineers.

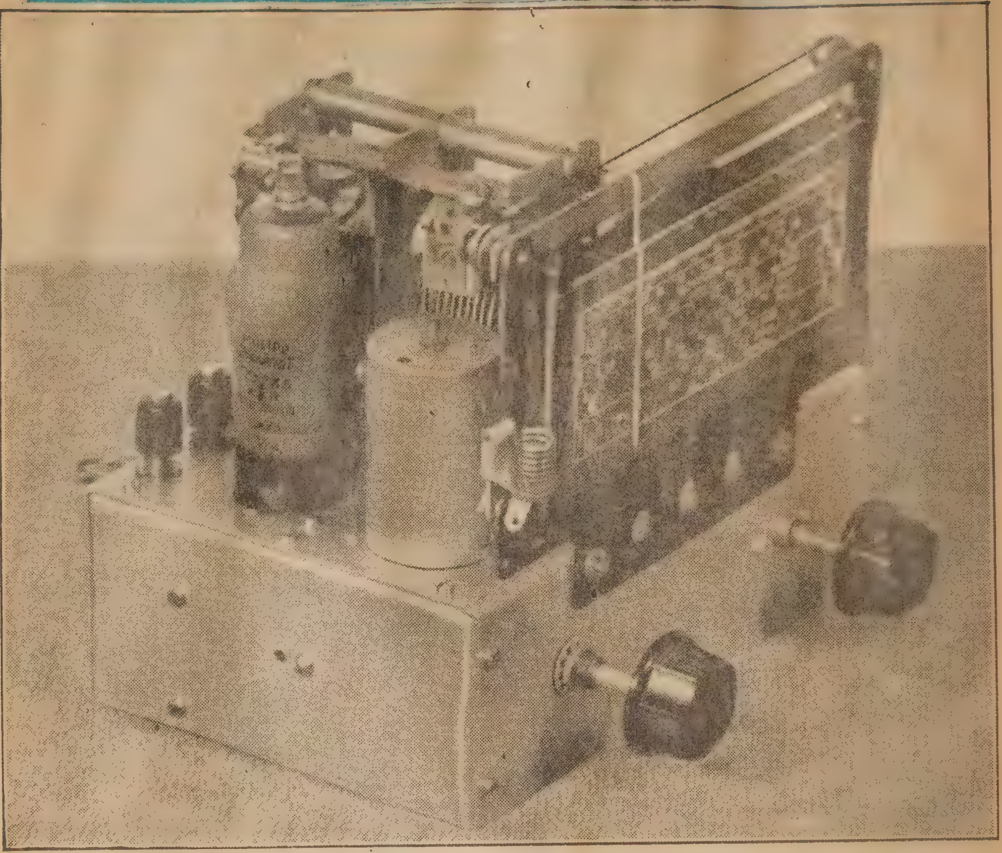
The time-tried Metallized filament principle is retained, but the ingenious construction, firmly based upon sound engineering principles, insures lower operating temperatures with proportionately higher wattage dissipation in a conveniently small, sturdy, light weight, fully insulated unit with an exceptionally low noise level.

Moisture cannot enter. No possibility of grounding. Element is *completely* sealed and insulated by molded bakelite.
Famous Metallized Filament Type Resistance Element—known for its dependability since the first days of Radio.
Insertion of wire leads *inside* hollow tube on which Metallized filament coating is placed aids rapid heat dissipation. Leads draw heat out of resistor.
Heavily tinned, flexible special alloy leads for quick, easy soldering. Leads anchored *inside* of insulation cannot turn or pull loose.
Note: Drawing is approximately twice actual size of BT-1 Resistor.
Enclosed, positive contact between resistance element and wire leads cannot be broken or become "open."

Available in ½w., 1w., 2w. sizes.

Sole Agents for Australia:

Wm. J. McLELLAN & CO.
BRADBURY HOUSE, 55 YORK ST., SYDNEY • PHONE [illegible]



The converter is self-contained on a neat little chassis.

A SHORT WAVE CONVERTER

Despite the popularity of dual-wave receivers, there is still a consistent demand for shortwave converter details. Here is a design which is simple, efficient and yet capable of being modified to use a variety of components which individual constructors may have on hand.

RIGHT at the outset it is perhaps wise to explain just how a shortwave converter operates. Essentially it is a device which utilises the superheterodyne principle to change the frequency of incoming shortwave signals to another frequency which falls within the tuning range of the main receiver.

Shortwave stations normally transmit on frequencies between 6 and 22 megacycles, corresponding to wavelengths of from 50 to 13 metres. But the ordinary broadcast receiver will only tune between say 1600 and 550 Kc., which isn't much help if you are keen to listen to shortwave stations. So, apparently, you either must be denied the pleasure or else trade in your set on a dual-wave job.

Of course, there is no one to prevent you doing either of these things, but the shortwave converter offers an alternative way out of the difficulty.

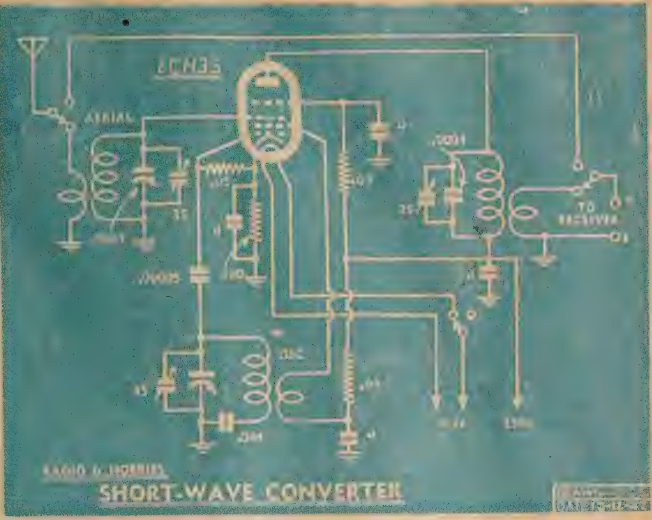
This most helpful device contains an oscillator stage and a mixer valve and the whole unit is connected between the aerial and the aerial terminal of the main receiver. The incoming signals are thus fed into the converter for treatment and then on into the receiver.

A converter operates by beating or heterodyning the incoming shortwave signal with locally generated oscillation to produce a heterodyne signal which falls within the tuning range of the main receiver.

In practice, the receiver dial is set to some spot, usually near one extreme of the band, where there is no incoming signal from a broadcast station. The shortwave stations are then tuned by means of the dial on the converter.

By way of example, the main receiver may be tuned to a frequency of 600 Kc., so that it will respond only to signals at this frequency. One may desire to listen for a

CIRCUIT OF NEW CONVERTER



The circuit is really the tuning end of a short-wave receiver.

station on 10 megacycles, so that the dial of the converter is rotated until the converter oscillator is operating at say 10.6 Mc. Under these conditions, the incoming signal will heterodyne the local oscillator to produce a difference frequency of 10.6 minus 10 Mc., equals 0.6 Mc. or 600 Kc. This signal carries the modulation content of the original carrier, so that the shortwave station is heard on the main receiver, just as if it were actually transmitting on 600 Kc.

In practice, of course, one does not need to work out a mathematical calculation each time a particular shortwave station is to be tuned in. The main receiver is simply tuned to a predetermined setting and the converter dial used to scan the shortwave bands, exactly as with a normal dual-wave receiver.

B/C RECEIVER

The inherent gain in the converter adds to that of the main receiver, so that the latter does not need to be a very pretentious affair to ensure reasonable results on the shortwave band. Any broadcast receiver which will tune all the locals easily and a selection of the stronger interstate stations will serve the purpose.

You can build the converter in any suitable form and set it atop the cabinet, connecting it by short leads to the main receiver. It need not be disconnected thereafter, since it can be brought in and out of operation by the flick of a switch.

Our suggested circuit is a relatively simple one, which lends itself to modification to suit individual components.

You will need a 2-gang tuning condenser with a maximum capacitance of about 400 mmfd. The exact type is not particularly important, unless it has to track with a special dial. A trimmer condenser should be connected across each section of the gang, if not already fitted to it.

Next requirement is a short wave aerial and oscillator coil, which appear to be available in several brands around the radio trade. The particular coils used in the original converter were fitted with variable iron slugs for low frequency adjustment, but this is not an essential feature.

COVERAGE

Some shortwave coils are designed for a frequency coverage of from 13-42 metres, others for 16-50 metres. There is not a great deal to it either way and you can use the coils which happen to be available or which happen to suit the particular gang and dial combination you use.

Coils and dials are calibrated, these days, for either the Stromberg "H" or the AWA gang. The frequency law of the two types is different, but the capacitance range is much the same, giving the same overall frequency coverage. If you use a condenser of older pattern, and having possibly a higher minimum capacitance the frequency coverage of the coils may be limited somewhat at the high frequency end of the band.

If you like to try winding your own, the aerial coil can be wound with 7¾ turns of 22 B & S enamel, on a ¾in. former and spaced out to one half inch in length. The primary is 3 turns of 34 B and S silk covered interwound from the bottom or earthed end of the secondary.

The oscillator grid winding can be similar to the aerial grid winding but having only 7¼ turns. The feedback winding is 5 turns of 34 B and S, DSC, with 3 turns interwound and 2 underneath the grid winding.

To the best of our knowledge, no dials are available especially calibrated for a shortwave converter. We used a small straightline dial with a shortwave calibration on the glass. The converter can be made to track quite well with this calibration, although the broadcast station markings have no significance. In using this dial, we had a thought in mind that the constructor could replace the original glass with a plain piece and slip behind it a white card suitably calibrated to the gang condenser and coils in use.

THE DIAL

The nature of this dial also had a bearing on the chassis dimensions and the cutout in the front for the drive cord. To obtain a balanced appearance of the controls, we found it necessary to partly dismantle the dial and to mount the drive spindle separately on the chassis. The cord is then lengthened — or replaced — with a scrap of fishing line, and rethreaded to move the dial pointer correctly over the scale. The switch is mounted on the left-hand side to balance the controls.

However, these are all mechanical details which you may or may not want to duplicate. Many folk likely to build this converter will have parts already on hand, so that the

PARTS LIST

1 Chassis 7½in. x 5in. x 2½in.
1 Dial
1 2-Gang Condenser
3 Trimmer Condensers
1 4 x 2 Switch
1 S.W. Aer. Coil
1 S.W. Osc. Coil

RESISTORS

2 50,000 ohm
1 35,000 ohm
1 300 ohm

CONDENSERS

4 0.1 mfd. 400V.
1 0.0004 mfd. mica
1 0.004 mfd. mica
1 0.00005 mfd. mica

VALVE

1 Type ECH35

SUNDRIES

Hook-up wire, spaghetti, mounting stri
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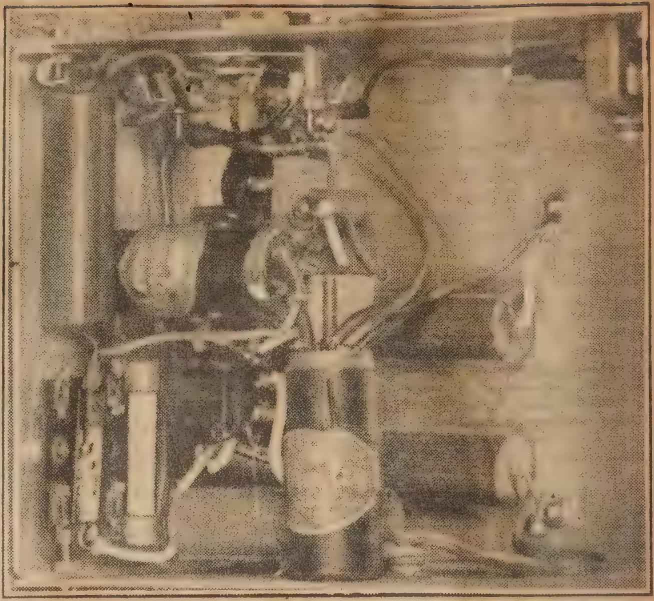

An underchassis view. The aerial coil is at the bottom, oscillator coil at the side. None of the components appear particularly critical concerning actual location.

whole layout can be revised to suit individual requirements. Here is room on the chassis for a midget power transformer and it also suggests itself for possible use with a small tuner. We are going to look into these possibilities and it is not unlikely that the chassis which ultimately appears on the market may carry modifications to meet these additional applications.

But back to the electrical circuit. The incoming signals are fed to aerial and earth terminals on the converter, the aerial being connected to one section of a 4-pole 2-position switch. You can use the sections of a single bank 3 x 3 switch, if desired.

SWITCH WIRING

The switch is so wired that the aerial is fed either to the internal circuits of the converter, or routed straight through to the broadcast receiver aerial terminal for ordinary broadcast reception. In this position, the heater circuit of the converter valve is opened, so that it ceases to draw current.

In the shortwave position, the signals are fed to the tuned aerial coil and thence to the signal grid of a converter valve, combining the functions of oscillator and mixer.

We used an ECH35 converter but almost any of the other comparable types will work well in the circuit. The ECH33 requires no change in the circuit, while the 6J8-G or 6J8-GA would require only a reduction in the oscillator anode resistor from 40,000 to 20,000 ohms. The same would apply for the 6A7, 6A8-G or similar pentagrid converters.

For the EK2-G, change the screen resistor to 0.25 megohm, the oscillator anode supply to 25,000 ohm and the cathode bias resistor to 500 ohms.

For the 6K8-G, reduce the screen resistor to 25,000 ohms.

The oscillator circuit itself is quite conventional, with the usual grid condenser and leak and a .004 mfd. padder capacitance.

Standard shortwave coils are made to operate with an IF amplifier channel at 455 kc. or thereabouts. Departure from this figure necessitates a variation in oscillator coil design and padder capacitance. To avoid the necessity for special components we suggest tuning the receiver to the extreme low frequency end of the band, or to the lowest frequency where there is a clear spot. In effect, the intermediate frequency for the converter will therefore be in the region of from 550 to 600 kc. This is near enough for all practical purposes, and you will find that the coils will track quite well.

OUTPUT COUPLING

For the output coupling we used an ordinary broadcast aerial coil, connected back-to-front. The normal grid lug connects to plate and AVC lug to B-plus. The winding can be resonated to the low frequency end of the band simply by connecting across it a condenser of .0004 mfd. and a 35 mmfd. variable trimmer.

The normal primary winding now serves as the output coupling link and, is connected to the output terminals for the purpose.

In the interests of efficiency it is a good plan to determine whether your receiver has a high or a low impedance primary. Nearly all receivers manufactured during the past 10 years have utilised high impedance primary windings, consisting of

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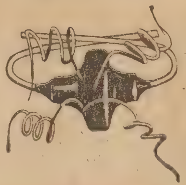

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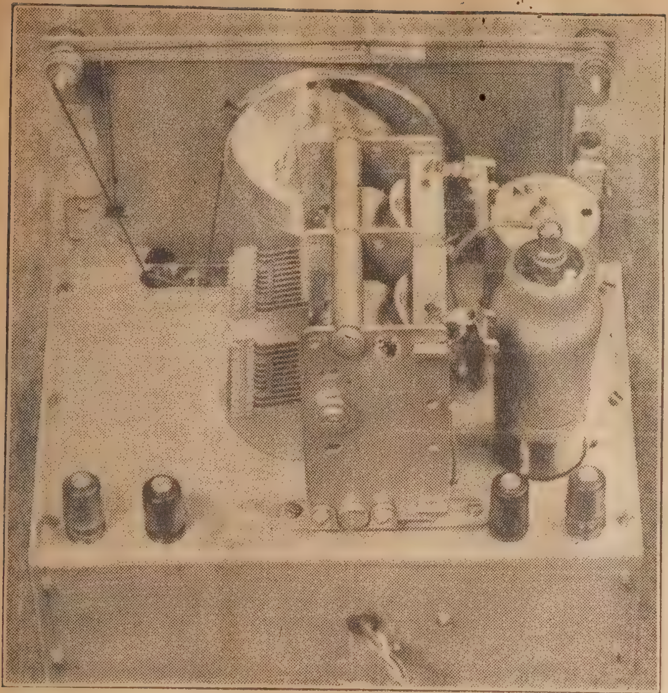

This top view shows the output coupling coil immediately behind the ECH35 converter valve. Aerial and earth terminals are at the left of the chassis—output terminals at the right.

many turns of fine wire in a large honeycomb winding. The older method was to use just 15 or 20 turns of wire as the primary—hence the term "low impedance."

If your receiver has been built within the last 10 years or so, or has definitely a high impedance primary winding, any of the modern aerial coils can be used successfully in the converter. With a set having a low impedance primary winding a better match would be obtained by using an output coil on the converter of generally similar pattern. However, these may not always be available.

You could make one up by winding about 140 turns of 32-gauge wire on to a 1-inch diameter former. For the output link, wind on 15 or 20 turns of the same gauge wire over the B-plus end of the plate coil, insulating it with a layer of empire cloth or good quality paper.

POWER SUPPLY

It would be a fairly costly business to build a complete power supply on the chassis of the converter, and the cheaper course is to derive the necessary heater and high tension supply from the main receiver.

To operate the heater you will need 6.3 volts at about 0.3 amp and about 250 volts and 10 milliamps for the high tension supply. Except in the case of small mantel receivers this additional load should not cause undue difficulties in the main set for intermittent periods of operation.

In most cases the supply voltages can be picked up most easily from the output valve socket. Identify the heater pins and run two wires out for connection to the heater wiring of the converter. The heater wiring will normally be connected to the chassis of the main receiver, so that no connection whatever should be made from the heater wiring to the converter chassis.

The earth wire between the two chassis will look after the negative high tension requirements, while the B-plus voltage can be picked up most easily from the screen pin of the output valve. Alternatively, it could be picked off the "hot" end of the voltage divider in some sets.

ADAPTOR

If you are loath to disturb the chassis of the receiver the voltages can be picked off the output valve socket by means of an adaptor arrangement, or more simply by poking wires into the appropriate socket holes and replacing the valve. However, if you go to the trouble of building a good converter it is a pity to compromise its usefulness by slipshod connections to the receiver.

The only remaining connections to make are from the output terminals of the converter to the aerial and earth terminals of the receiver. These leads should be no longer than necessary and can be made with a pair of wires twisted together. Make sure to connect the insulated output terminal of the converter to the aerial terminal of the set, leaving the other wire to connect chassis to chassis.

(Continued on Page 83)

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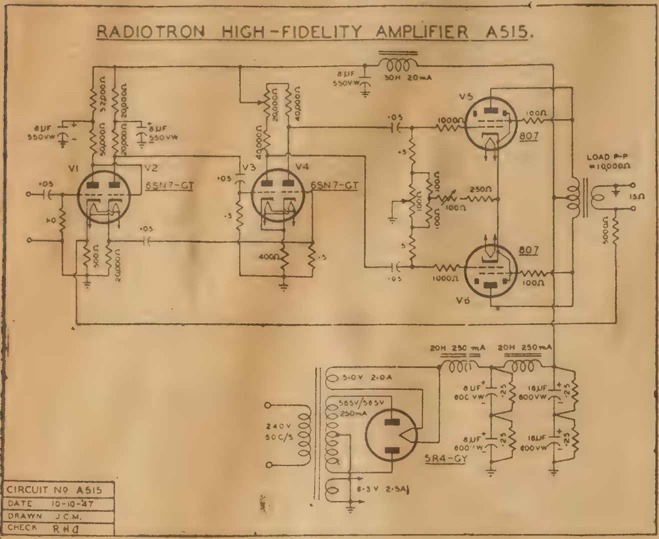


The latest issue of "Radiotronics" contains details of a most interesting amplifier. The Valve Company report on the circuit says: This amplifier is by far the best we have ever tested. It not only gives extraordinary linearity and lack of harmonic or intermodulation distortion, but is comparatively simple and involves no special problems except the choice of output transformer.

IF it is desired to reduce distortion to the absolute minimum, there appear to be two possible approaches. The first is the application of push-pull pentodes (or beam power valves) with a high degree of negative feedback. Although capable of providing extremely good results, the design is complicated by the high degree of feedback and the precautions which require to be taken to avoid instability.

The second approach is through the application of push-pull triodes with negative feedback. In this case the initial distortion is considerably less, and the degree of feedback necessary to provide the required fidelity is not so great as to require abnormal precautions in the feedback loop.

ORIGINAL DESIGN

We were interested to read an article by D. T. N. Williamson, "Design of a High Quality Amplifier" in the "Wireless World," April and May, 1947, using push-pull triodes with negative feedback. We therefore adapted it to suit own own valve types and then caried out tests to see whether the claimed low distortion limit of less than 0.1 per cent. total could be reproduced.

The original amplifier used one triode valve as a resistance coupled amplifier with its plate directly coupled to the grid of a second triode operated as a phase splitter and cathode. loads. The plate and cathode of the second valve were capacitance coupled to the grids of the push-pull triodes, which in turn were capacitance coupled to the grids of the power valves.

TRIODE CONNECTED 807's

The latter were the English type KT66 which is somewhat close in characteristics to types 6L6 and 807. The KT66's were operated with plate to cathode voltages of about 400 volts which were in excess of the maximum triode ratings for either type 6L6 or 807.

In order to attempt to duplicate the results obtained in the English amplifier, tests were carried out on type 807 to see whether it could be used with the higher screen voltage in triode operation. During these tests we had no valve failures and subsequently arranged for a number of 807 valves to be placed on life test with triode connection and a combined plate and screen voltage of 400 volts to cathode.

The results of these tests will not be known for some months, but in the meantime there does not seem to be any reason why the valves should not be used under these conditions for individual amplifiers at the risk of the user, since the risk appears to be quite small.

The screen dissipation is considerably below its maximum value and the only possible breakdown is through the increased screen voltage causing electrolysis or breakdown in the stem-press between adjacent leads. It would, of course, be possible for the output valves to be used within their maximum ratings by reducing the voltage from 400 to 300 but the power output would then be considerably smaller.

The valves used in the original voltage amplifier stages were type L63, which has characteristics resembling those of type 6J5-GT or one half of type 6SN7-GT. It was therefore decided to use two 6SN7-GT valves, one in place of each pair of L63 valves. This gave a valve complement of two type 6SN7-GT, two-type 807 and one type 5R4-GY rectifier.

PHASE SHIFT

Special attention was given in the original design to the avoidance of phase shift. The direct coupling from the plate of the first valve to the grid of the second valve eliminated one possible cause of phase shift at low frequencies, while the cathode return circut was purely resistive. All the cathode resistors are unbypassed so as to avoid any phase shift at low frequencies, leaving only the coupling condensers to the third and fourth stages, and the output transformer.

The latter was required to have a primary inductance of at least 100 henrys, measured at 50cs. with five volts rms on the primary, leakage inductance of not more than 30mH measured at 1000cs. and a primary resistance of the order of 250 ohms. In order to avoid the delay in having a special transformer made for the job, we substituted various transformers which were on hand. It was found that the transformer supplied with the Goodmans 12in. loud speaker would give quite satisfactory results, and this was therefore adopted for the initial tests. An order has been placed for a transformer specially designed for this amplifier, which should be available at a later date.

STATIC FIGURES

The amplifier was then wired up in accordance with the circuit diagram given herewith (A515).

The static plate currents in the final stage were balanced, and the drive to each valve was adjusted to give equal outputs at the plates when the valves were supplied with d-c. through separate chokes with individual loads of 5000 ohms each. The cathode bias resistors on the final stage were adjusted to keep the total plate dissipation less than 25 watts per valve. Without feedback, the amplifier was perfectly linear up on an output of 7.3 watts on a resistive load. With feedback, the amplifier was perfectly linear up to an output of 11.12 watts and it gave a smooth overload so that an output of 15 or 16 watts could be achieved without serious distortion.

The harmonic distortion for a power output of 11 watts was 0.01 per cent. 2nd harmonic, 0.04 per cent. 3rd harmonic, 0.01 per cent. 4th harmonic and 0.015 per cent. 5th harmonic. Even with an output of 17 watts as for an overload condition the distortion only reached the values of 0.46 per cent. 2nd harmonic, 0.31 per cent. 3rd harmonic, 0.53 per cent. 4th harmonic and 1.25 per cent. 5th harmonic.

SPEAKER LOAD

When tested on a speaker load it was found that for fairly large outputs at low frequencies a high frequency oscillation (about 60kcs.) would commence and be accompanied by a pulsed output of some other frequency. Both these incipient oscillations were cured by the addition of a 0.0005uF capacitor from earth to the screen of the 807 valve which tends to provide positive feedback to the cathode of the input stage. It was found that the by-pass was slightly more effective when connected to the screen than to the plate.

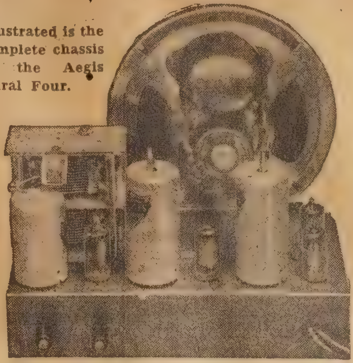
STATIC MEASUREMENTS
(with Avo model 7)

	No output	15W. output
Ground to cathode of V5 and V6 ..	39.0V	28.8V
Cathode to plates of V5 and V6 ..	400.0V	425.0V
Screen dissipation of V5 and V6 ..	2.16W	1.8W
Plate dissipation of V5 and V6 . ..	47.4W	36.4W
Total B+ voltage	440.0V	452.0V
Total B+ current	142.0mA	112.0mA
Ground to filament of 5R4-GY	465.0V	565.0V
Input voltage to V1 (rms)		1.55V
Input voltage (rms) to V1 with no feedback		.144V
Input voltage (rms) to V5 and V6 (grid-to-grid) ..		85.0V
Output resistance .		0.3
Damping factor (RL/Ro)		50
Hum output (across 15 ohms)	0.34mV at 50cs. 0.06mV at 100cs.	

The following tests were carried out with this addition. It was found practicable to apply sufficient feedback from the voice coil to the cathode of the input stage to provide 20db reduction in output with complete stability under all conditions. The phase shift between the input and output was quite small over a frequency range of 20cs. to 13kcs.

The frequency response on a resistive load was constant from 20 to 10,000cs. and rose only 0.42db

(Continued on Page 55)



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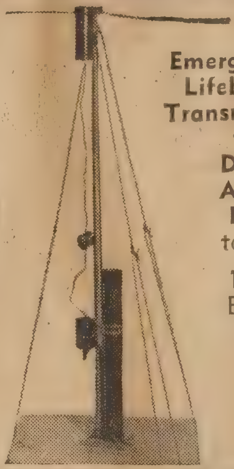

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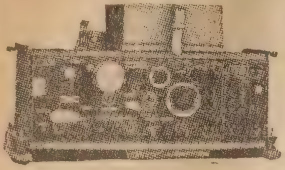

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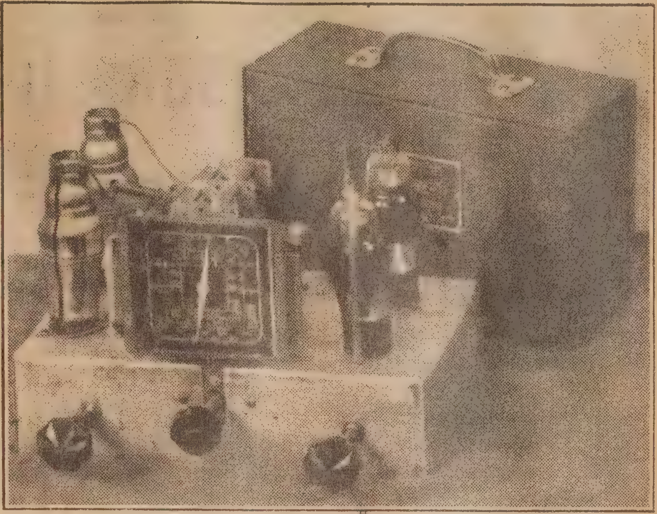
HOW TO USE VIBRATOR POWER UNITS



Here is the 1K5-Four receiver, modified to operate from a 6 volt filament supply and attached to a commercial vibrator power supply.

In recent months, there have been numerous enquiries through our query service relating to the use of vibrator power supplies. Can commercial vibrator supplies replace B-batteries, and, if so, what changes are necessary to the receiver?

THE principle of the vibrator power supply has been explained previously on more than one occasion. Briefly, a vibrator cartridge is used to interrupt rapidly the flow of current from the energising battery through the primary winding of a special transformer.

This interrupted d-c is, to all intents and purposes, equivalent to an alternating current of square waveform, and it is stepped up to a much higher voltage in the secondary of the vibrator transformer. It is rectified by a second set of contacts on the vibrator—or by a separate rectifier valve—filtered by a choke and condenser combination and applied to the high tension circuits of the receiver.

EFFICIENCY

The overall efficiency of a vibrator system is generally around the 60 per cent. mark. Assuming that the receiver will draw 15-odd milliamps at 150 volts the high tension wattage required is 2.25. Allowing for 60 per cent. overall efficiency, the wattage input to the primary will be about four watts, representing a current drain of just under 0.7 amp at 6.0 volts.

If charging facilities are readily available this current drain is not a very serious factor, and many country listeners prefer to arrange and pay for the charging of an accumulator at intervals rather than to purchase a complete new set of B-batteries every six months or so. Hence the increasing popularity of vibrator-powered receivers.

"Radio and Hobbies" has described in detail the construction of several vibrator receivers in recent months, and these have all been well accepted by readers who have contemplated the construction or remodelling of a receiver. But there are naturally other readers who have neither the experience nor the inclination to tackle such a task and who are more interested in less extensive measures to achieve the same result.

USE OF UNIT

Assuming that a battery receiver is already on hand, one obvious course is to add a vibrator power supply unit to replace the B-batteries. With this in mind at least two manufacturers have released power supply units for the purpose. Another aspect is that certain of the vibrator supply units from ex-military equipment can be used for the same purpose.

Most battery receivers are designed to operate with a high tension supply of 135 volts from B-batteries, and anything between 120 and 150 volts can be applied to them from a vibrator supply without risk of improper operation. Caution is necessary, however, before applying such a voltage to a receiver normally operating on a 90-volts supply. In some cases it may be using the 1.4 volts series of valves, which are specifically limited in their ratings to 90-odd volts. Or the valves themselves may be rated to operate at a higher voltage, but only with adequate grid bias.

This point affects mainly the output valve, which may draw excessive current unless the correct relationship exists between grid bias and the plate supply voltage.

There can be no general rule about this, and we can do no more than offer the word of warning. Check the characteristics of the output valve on a data chart and note the bias it requires for the particular operating voltage. The adjustment can be made either by varying the C-battery tapping or the value of the back-bias resistor, if such is used. In case of doubt consult your local serviceman, who will understand such problems.

BACK BIAS

Mention of back-bias raises another point. Many receivers use this scheme to obviate the need for a C-battery. We have done it ourselves in several of our sets. Without going into lengthy discussion the use of back-bias means that the B-minus lead does not go direct to chassis, so that there can be no common connection between the filament and high tension supplies. If connection is made external to the receiver between A— and B— the back-bias circuit will automatically be shorted out.

There is no complication about this with full battery operation, since the connections are made as directed by the manufacturer and the owner remains blissfully ignorant of the circuit arrangement inside the chassis. And no one would dream of deliberately running a wire between A— and B— unless it were specifically called for in the battery connections.

If the absence of a C-battery suggests that your receiver uses back-bias, it will be essential to maintain independance of the filament and high tension supply accumulators. Even the chassis of the vibrator unit should not be joined directly to the receiver chassis, unless a continuity test indicates that there is no connection within the unit between B-minus and frame.

The only possible exception to the above remarks would be in the event of the vibrator supply having a split reed cartridge, which does allow isolation of the high tension output from both frame and the energising battery. But split reed cartridges and circuits to suit are the exception rather than the rule.

ACCUMULATORS

Receivers intended for full vibrator operation derive their whole supply—filament and high tension—from a single accumulator, which is obviously most convenient. But, HAM news

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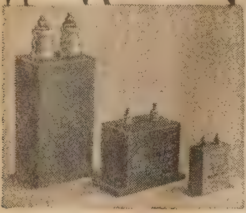

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.25	2500	—	3/3
1	1500	—	7/6
1	2000	W	8/9
2	800	T	1/6
2	1000	T	2/6
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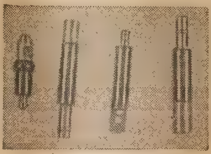

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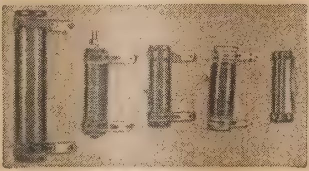

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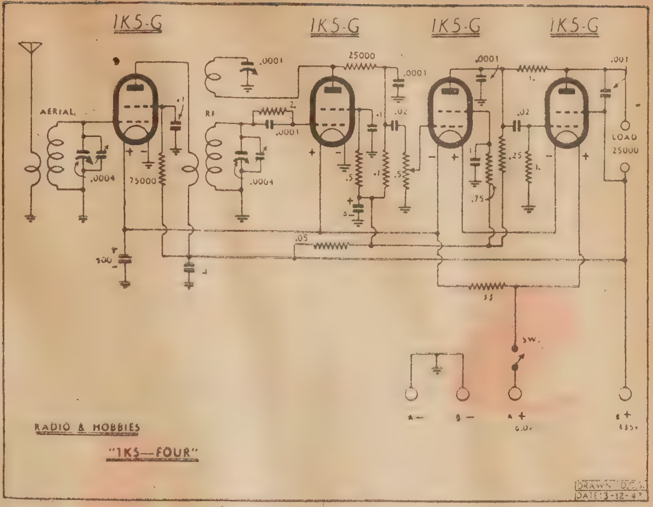

The schematic circuit of the 1K5-Four, with series-parallel filaments. Note how the filament circuit provides bias for the last two valves.

generally speaking, an existing battery powered receiver cannot be operated from a single accumulator without special provision being made in the circuit or connections. And, unless you are competent to analyse the requirements and make the necessary alterations, it will be necessary to retain the usual 2.0 volt accumulator for the filaments and provide a separate accumulator to run the vibrator supply.

One of the complications has already been mentioned, namely, when back bias is employed. The other is in regard to the filament circuit itself.

The normal battery receiver requires a filament supply of 2.0 volts at about 0.72 amp., to take a typical case. Provided A- and B- are both returned to chassis, the A-plus voltage could be tapped off the first cell of a 6,0 volt accumulator. An immediate difficulty is that the current drain on the first cell is then likely to be about twice that from the other cells, so that it will run down much more rapidly. And the greatest care is necessary to avoid accidentally connecting the 2.0 clip to the wrong lug, thereby damaging the valves.

RIPPLE

A still further complication is that the pulsating nature of the current drawn from the vibrator creates a ripple in the output from the accumulator, which is likely to cause hum by its effect on the filament circuit. One or more 500 mfd. electrolytic condensers across the filaments will minimise this effect.

Better still, the correct dropping resistor can be calculated to connect in series with the A-plus lead and allow the filaments to operate from the full six volts. The value in ohms is given by dividing the voltage drop (normally 4.0) by the current drain in amps. If the current is 0.72 amp., the resistor value will be 5.5 ohms.

If the voltage dropping circuit incorporates a low tension choke as part of the total circuit resistance, and one or more 500 mfd. electrolytic condensers, there should be no difficulty with filament circuit hum.

In an extreme case, a mica bypass condenser and a low tension RF choke may also have to be included in the filament circuit as a precaution against RF hash. Whether this is necessary or not will depend as much as anything on the amount of primary circuit filtering incorporated in the vibrator supply itself.

FILAMENT WIRING

In a receiver designed for vibrator operation the filaments are invariably connected in a series-parallel combination, which allows them to operate from the six-volt supply with a minimum wastage of power in dropping resistors. But, unfortunately, a series-parallel connection affects the whole design of the receiver.

The filaments themselves have to be so connected that each one passes just the correct amount of current, no more and no less. Any inequality in the network, due to different filament current rating, or to an odd number of valves, must be compensated by the addition of shunt resistors.

FILAMENT POTENTIAL

The connection means that some of the filaments have to be positive with respect to chassis. What is effectively a negative bias of equal value thus appears between the grid — through its return circuit—and the negative filament pin, which is the reference point for bias in a battery valve. The filaments, therefore, have to be arranged in an order which will take into account or utilise this filament circuit bias to best advantage.

Add to that the problem of removing hum and avoiding feedback troubles, and it becomes clear that a good understanding of all the problems involved is necessary before one tackles the re-design of a filament circuit. Also why we will not re-design filament circuits for individual readers through the query service.

The influence on design is illustrated by the "1K5-Four" circuit modified to a series-parallel filament connection. The filaments of the RF amplifier and detector valves are at the earthed end of the network, so that they have no initial potential with respect to chassis. Both grid circuits are returned to chassis, so that both valves operate, as they should, with zero grid bias.

AUDIO BIAS

The filament of the audio voltage amplifier is in the centre of the network, so that its filament is initially 2.0 volts positive with respect to chassis. The end of the volume control is returned to earth, so that the grid acquires an effective bias of —2.0 volts. This is half a volt more than was applied from the original bias battery.

At the positive end of the network the output valve filament is 4.0 volts positive with respect to chassis, so that the grid return to earth gives this valve an effective bias of 4.0 volts.

Balance of current is maintained in the filament network by connecting a 33 ohm resistor in parallel with the two filaments at the positive end. This will naturally pass 120 milliamps with 4.0 volts across it.

As a precaution against filament circuit hum, a 500 mfd. electrolytic condenser is connected in parallel with the detector and RF amplifier filaments.

BENCH TEST

In this form the receiver was tested in conjunction with a commercial vibrator supply unit having a built-in filter system for the filament supply. Excellent results were achieved. In line with the manufacturer's specifications we found it essential to run separate leads between the vibrator supply and chassis for the A— and B— connections and for the filament and cartridge supplies to the vibrator. Common leads caused trouble with RF hash.

Connection to this receiver was simplified because it already included dropping resistors for the screen of the valves. In some receivers the intermediate supply voltages are derived directly from tappings on the batteries, and these tappings are naturally not available from a vibrator supply. The normal course is to connect resistors in series with intermediate voltage leads, such that the right amount of voltage drop is obtained from the full high tension supply.

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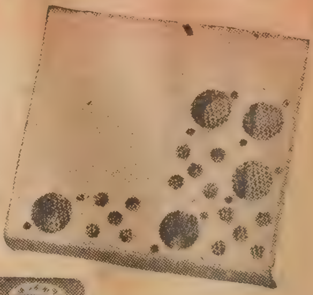

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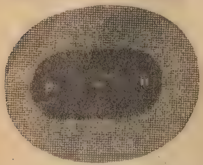

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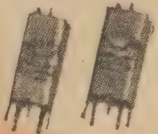

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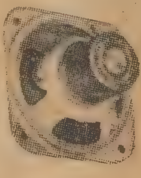

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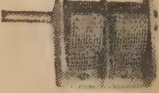

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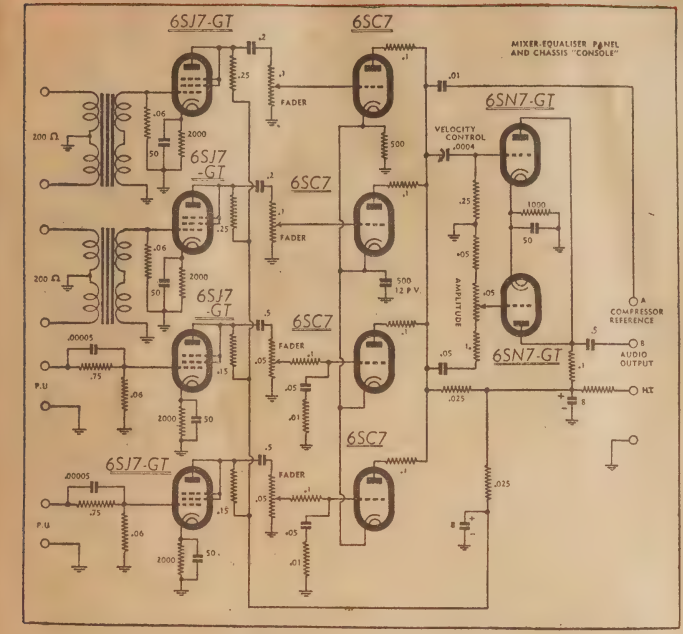

Circuit details of the microphone preamplifier stages and the medium impedance mixing system. Note also the treble boost control.

The contributor of this article has had wide experience in the field of commercial recording. In this second instalment he takes up the subject with a discussion of playback needles and their effect on the life and fidelity of acetate recordings.

THE next item of interest is the playback used on acetate recordings. This subject can best be dealth with, by describing a typical commercial pick-up.

"This pick-up is specifically designed for the playback of acetate recordings, and has virtually no damping. The needle-point pressure is less than 2oz., and the tracking error is reduced to vanishing point by either a very long arm, or by off-setting the head on a somewhat shorter arm. The armature is kept small, and the **needle itself** is by far the **greatest mass** in the entire moving assembly. The damping can thus be reduced to result in a greater degree of stylus compliance than previously possible. The consequent increase in record life is considerable, and this factor outweighs any disadvantage arising from peaks falling **above** the 5000 cycle region. The exact frequency at which such peaks do occur depends entirely on the shape and mass of the needle, and in the worst cases will not be worse than plus-or-minus 5db. It is estimated that an increase in record-life of 50 per cent. is achieved by the use of this type of pick-up."

Attention has now been drawn to the needle itself. As might be expected, this must be shaped to fit the sound track snugly. It should not ride up on the "shoulders" of the groove (as is the case with a blunt point), nor should it ride on the bottom of the track only, without touching the walls.

NEEDLE SHAPE

For minimum wear of the disc, the playback needle should touch as much of the walls and bottom of the groove as is practically possible. Correct playback needles are manufactured by the people who make the cutting stylii, and this problem is obviated. It should be mentioned that even the best of gramophone needles, the ordinary commercial type, can NOT be used on acetates.

Many acetate-playback needles are "triple-shadowgraphed." This means that their silhouettes are projected on to a large screen, with a strong light behind the point, and the shape can be observed critically. The usual radius of the tip is about .002in.

The two cutting speeds are 78 and 33 1-3 rpm. The higher speed is standard for 10 and 12 inch discs, whilst the 16-inch "transcription" type, which holds a complete quarter-hour programme, is always cut at 33. The advantage of the slower speed is obviously that the disc plays longer for a given disc diameter—BUT slow-speed recording brings with it a fresh problem, namely the **lineal velocity effect.**

High frequencies, recorded at the centre of the disc, where their waveform is, so to speak, compressed, must necessarily have very sharp bends. Since no playback needle likes to follow extremely sharp bends, the tendency is for the playback needle to "ignore" the bends and plough through them. This results in a serious loss of the higher frequencies, and the effect at the innermost part of the disc is so serious that even speech cannot be properly reproduced.

TREBLE BOOST

The technique used to combat this treble-loss effect is to reduce the **overall** level at inside cutting regions, and boost the treble considerably—sometimes as much as 20 db. at 5000 CPS. This enables a fairly good-quality track to be recorded at 33, to a minimum disc-diameter of about 8 inches.

Closer in than this, even the most intense treble-boosting is not very satisfactory on music, although speech, with rather poor quality, may be recorded to about a 7 inch diameter. But with an 8-inch start (or finish), the 16-inch-diameter disc can hold a nominal quarter-hour session on one side, 16-inch discs are never recorded at 78 rpm.

Although one might expect the slower speed to give an inherently lower surface noise, this may not be true. The fact appears to be that at 78 the stylus has a clean, scooping action, but at 33 it has a tendency to "tear" the material out. Perhaps the choice of words is unfortunate, but the principle is acknowledged by leading manufacturers of instantaneous recording equipment.

SIDE-WALL CHATTER

"Side-wall chatter" at 33 is a tragedy. Sometimes one can hear a whole sentence repeated faintly in the background. At 78, the chatter is more likely to be confined to one or two words. This is quite natural, as the speed is more than twice as great. The stylus also tends to bite deeper at 33, for a given set of conditions, and what may be a classical set-up at 78 might give a severe sidewall-chatter at 33.

However, to round off the subject of cutting speeds, we should have brief reference to the various **times** of playback, for various speeds and disc-sizes. As already mentioned, the quarter-hour pro-

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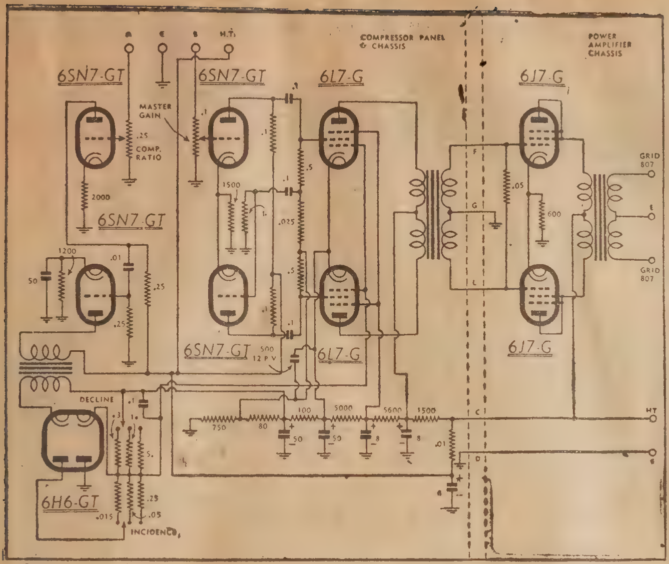

Connected in circuit between the preamplifier stages and the drive to the final valves, the compressor guards against overcutting due to unexpected sound levels.

gramme is recorded on a 16-inch disc at 33 rpm. A 7½-minute session can conveniently be recorded on one side of a 12-inch disc at 33. A five-minute show, one side of a 12-inch disc at 78; and a three-minute job on one side of a 10-inch disc at 78. The 33 speed is never used on 10-inch disc, because the lineal-velocity effect forces the recording engineer to start at a minimum diameter of about eight inches, so the playing-time is about the same, whether the 10-inch disc is cut at 78 or 33.

In the amplifying equipment the preamplifiers are triodes, their outputs being attenuated by medium impedance faders. These tubes are preferred by the writer to the "1600" series from the point of view of heater-to-cathode noise, and they also seem to be less sensitive to the effects of magnetic fields. Noiseless amplifiers have been built with these tubes, operating at minus-113 db from photo-electric cells, with the power supply of an associated 120 watt unit less than 2ft. away.

LOWER HUM

As for the other matter, the heater wires in the 1600 series are parallel inside the cathode sleeve, with a fairly high leakage field; but the 6SJ7 has the modern twisted heater, with correspondingly lower leakage. Their microphonics are also quite low.

The medium-impedance faders are used for several reasons; the first is that they do not have the centre-position high-note loss which is peculiar to some high-impedance faders. Then, again, there is no need for the double insertion-loss of the input and output transformers, which are associated with low-impedance faders. And, having eliminated the transformers, we have simultaneously eliminated a critical source of hum induction.

The use of the medium-impedance plate circuit is permissible with triodes having a very low Rp, but would not perhaps be quite such a happy choice with pentodes in the pre-amplifier stage, as the shunting effect would be such that the realisable gain of the pentode stage would only be small compared to that which can be obtained from pentodes when the shunting is light. Altogether, we found that a greater amount of gain, with better fidelity, and at least 10 db. less noise, could be obtained from the 6SJ7 as a triode, rather than as a pentode.

MIXING SYSTEM

Mixing is accomplished by a tapped plate load on the mixer stage, with the isolation system for the plate circuit of each individual tube. The system is simple and effective, and was chosen after considerable research into the various other systems.

The treble boost system is a rather special circuit, which forces the signal to go through the frequency-discriminating path provided by the variable condenser, when the linear drive is throttled off by the potentiometer in the lower grid of the twin triode.

The Volume Compressor stage employs push-pull 6L7's. The choice of the 6L7 allows the control voltage and signal voltage to be applied to independent grids. The programme is fed to the low gain grids (grid 3 in each tube), whilst the biasing potential is applied to the high-gain grids in parallel (grid 1 in each tube).

The stage driving the compressor is a typical paraphrase, the drive for the rectifier-amplifier being **unequalised.** Drive for the cascade rectifier-amplifier is taken from the output of the **mixer,** not the equaliser.

To summarise the action of the volume compressor, AVC is deve-

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loped across a diode load resistance, and partially filtered by a capacitance. It does not have to be fully filtered, because the residual audio content is fed in phase to the two parallel control grids, and the resultant signal, if any, cancels in the balanced output transformer.

LOW DISTORTION

Apart from this action alone justifying the push-pull connection of the compressor stage, it should also be noted that the even-harmonic distortion is reduced or eliminated by the push-pull system. When variable-mu tubes are biased-back under AVC action, their distortion becomes fairly severe. This circuit can give about 15 db. of compression without objectionable distortion on speech, and a good 10 db. on music, with excellent fidelity.

The compression action enables an enormous rise in the average recorded level. It permits the signal to be at all times above the inherent surface noise of the disc, yet below the threshold of overcutting. Admittedly, you do get some distortion under high degrees of compression—but you do **not** get the accompanying overcutting.

In recording, you can only make one mistake as regards overcutting. On a broadcast station, a sudden peak in the level might cause an instantaneous splash of overmodulation, and possibly the final tank condenser will flash over. But, in recording, one solitary passage of overcutting may—and frequently does—spell ruin to the record.

You will deduce from this that the action of the compressor must be very fast. This forward action we call the "attack" or "incidence." In this circuit, the attack is variable. The sharpest attack is about three milliseconds, which seems to be satisfactory for most sounds likely to be encountered in recording. Some commercial compressors claim to achieve an attack which is absolutely instantaneous, but this calls for very heavy diode loading because of the absence of any series resistance in the attack circuit. The diode driver should then be able to deliver appreciable power to what amounts to a short circuit, as the AVC capacitance takes the charge.

TIME CONSTANT

Note that the release circuit, which allows the decay or decline of the AVC voltage across the capacitance, is also variable, and in this case the slowest release is about one second.

The exact time-constants of both circuits depend on the nature of the sound being handled, and a competent technician will be able to deal with this as it comes along, for the rehearsal will have told him what to expect. He must, of course, have a good memory, to know just when to modify his time constants to cope with some explosive artist or group of instruments.

Among radio actors, female artists seem to be rather prone to uttering shrill screams and such, when the

(Continued on Page 83)

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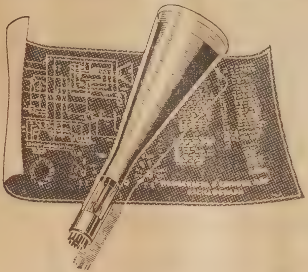

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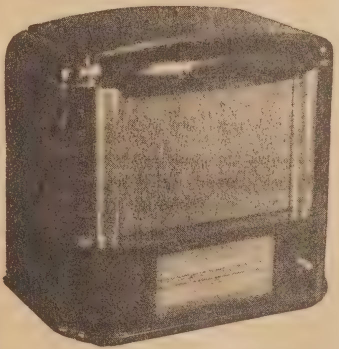

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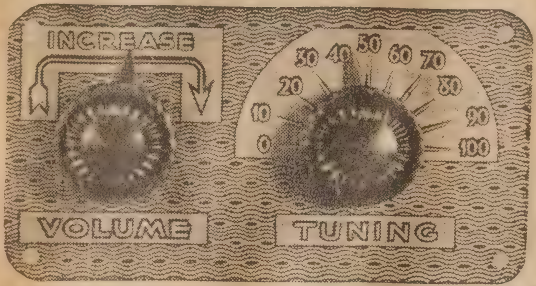

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FROM THE SERVICEMAN WHO TELLS

The demand for built-in furniture caught up with me this month, when I had to supervise the building in of a radio receiver. Quite a few interesting points arose out of the job and these are mentioned by way of general interest.

THE owner of the set—a personal friend—asked me about the matter a few months back, when his new home was being planned. In keeping with the modern trend, he was arranging for built-in cupboards, &c., and thought to eliminate the decorative, but rather bulky, cabinet housing the family radio.

Looking at the plans, I noticed that a dummy chimney was provided for across one corner of the living-room, and the obvious suggestion was that the speaker could be mounted behind a decorative grille in the face of the chimney. Perched just above the mantelshelf, it would be at or above ear level, and facing straight out into the room.

The chassis itself could mount quite conveniently in the cupboard space of the adjacent room, leaving just the knobs and dial visible through a panel in the wall.

INTERNAL WIRING

This general scheme was adopted, and, while the house was in course of construction, five wires were run from the speaker position in the false chimney to the chassis position in the built-in cupboard. These would cater for almost any combination of chassis and speaker.

Anyhow, the house was completed a few weeks back, and it fell to me to remove the units from the cabinet and see them installed safely in their new positions.

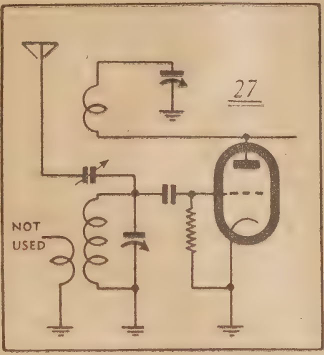
The speaker mounting arrangement had been executed nicely by the builders. Heat from the gas fire was conveyed up past the speaker position by an asbestos cement flue, so that there was no danger of heat and fumes affecting the loudspeaker. A solid baffle had been mounted on the framework of the false chimney and merged with the plaster, the front being covered with cabinet silk and a chromium plated grille of appropriate styling.

SPEAKER PANEL

Access for speaker mounting was by a removable panel in a rear wall, and the work had been done faithfully in that there was no suggestion of rattles when the plaster of baffle was bumped with the hand. It was only the work of a few minutes to screw the speaker in position and to connect up the leads.

Incidentally, I extended the existing speaker leads by attaching a 5-pin plug and a 5-pin socket, correctly wired, to the respective ends of the cable. It was then simply a matter of plugging the cable into the chassis and the speaker into the remote end of the cable. No trouble was expected or experienced from instability, since the extension amounted to only a few feet.

On test, the owner was immediately surprised and intrigued by the different sound of the receiver, as was only to be expected. The treble was more obvious, due to the fact that the sound was being projected straight out at ear level, instead of along the floor, as in the case of the usual console cabinet.



Use of condenser aerial coupling gave this receiver more volume.

But the most obvious difference was at the bass end, where the reproduction had a full quality, without obvious speaker resonance effects. This, too, was only to be expected, since the speaker was mounted on a substantially infinite baffle, with no path at all between the front and back waves.

CHIMNEY EFFECTS

Speaking generally, chimney installations are liable to peculiar effects. If a speaker is sealed on a heavy baffle across a fireplace, the chimney tends to act as a tuned air column, which may or may not give a pleasing effect. It will be pleasant if the resonant frequency is very low, but not so pleasing if it tends to reinforce the natural resonance of the speaker.

There was no trouble of this nature in the particular installation I am referring to, since the false chimney resembled in shape a large triangular cabinet, with an open top.

The chassis caused me some concern, however. It was of fairly old make, but a good one, and the owner naturally did not want to discard it without good reason. But it was patent that the dial had to be changed. This recalls some remarks I made a couple of months back on the subject.

My friend wanted one of the new horizontal edge-lit dials and it was obvious that the gang condenser already fitted to the chassis would not track with it. So I stripped off the old condenser and fitted the new units, hoping that the coils would give the right band coverage.

However, luck was not with me because I found that no amount of juggling with the trimmers could bring the high frequency stations anywhere near their correct positions on the dial. Even with the oscillator trimmer wide open, 2SM came in a full half-inch beyond its calibrated position, and it became obvious that the old solenoid oscillator coil had too much distributed capacitance to fit in with the calibrated dial coverage.

COIL REPLACEMENTS

After all, it was probably designed for a band coverage of from 1500 to 550 Kc., whereas all modern dials are calibrated down to 1600 Kc.

Accordingly I replaced the old solenoid oscillator coil with a modern iron-cored unit and tried again. The difference in distributed capacitance was amazing, for the high frequency stations could now be tuned in the correct position with the oscillator trimmer screwed about half in. Fortunately, the other coils peaked up satisfactorily, so that they did not need to be replaced.

The set was therefore re-aligned correctly, the dial made to track, and the whole chassis fitted into the prepared niche, with knobs and dial facing out into the living-room. I liked the whole arrangement and it is mentioned for those who may be planning a new home, or measures to get rid of surplus furniture in the living-room.

Strange, isn't it? A few years ago we bent all our efforts to filling the rooms with furniture. Now just as much effort goes into removing it.

IN THE COUNTRY

I don't know whether radio men acquire some distinctive appearance which betrays their calling to their fellow-beings. If such is the case, I must be a victim of occupational appearance.

Only last weekend I packed the family into the car and hied off to a country centre about 70 miles out from the city. I had not been in the dining-room more than six minutes before an elderly lady ac-

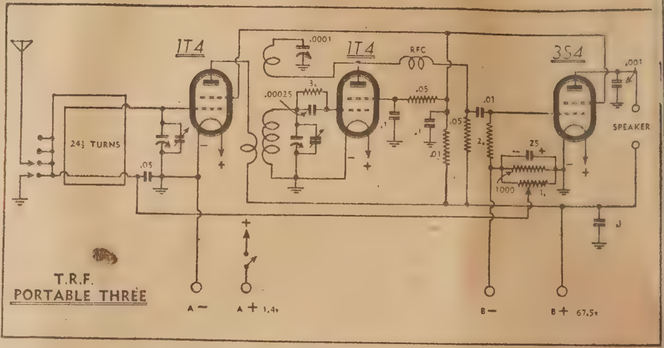
(Continued on Page 92).

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

A 3-VALVE T.R.F. PORTABLE

A reader from Fitzroy, Victoria, Mr. H. J. Scott, is very keen about the results he has obtained from his three valve T.R.F. portable set. Here is the circuit and a brief description of the set for those who may like to try it out.



MR. SCOTT writes: I have been prompted to write by the appearance of "Tom Thumb" in a recent issue. To put it plainly, I want to let off steam about the results I obtained from a similar little set with the addition of an RF stage. You will find a copy of the circuit enclosed.

I had to use standard-size components, with the exception of the valves, and included an English type two-gang condenser. But I still managed to get the lot, with two Minimax 67½-volt and two miniature 1½-volt cells in a box 8in x 6½in x 4in.

Both sets of batteries are in parallel for long life. After six months I still have the original B batteries and am on the second set of A batteries.

The results have been amazing. Operating with the loop only in th suburbs of Melbourne, I receive al the Melbourne stations at speaker strength. With an indoor aerial an earth and phones, I have receive every State in Australia.

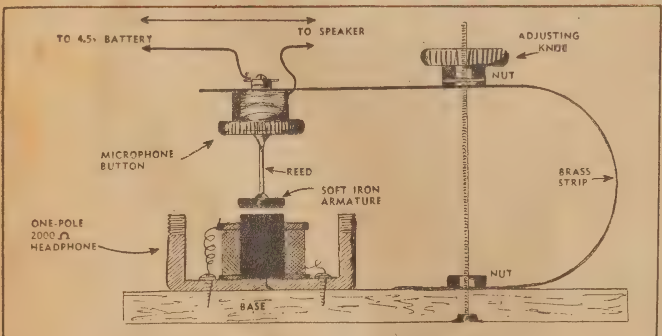
Up in the mountains, about 10 miles from the city, I use it wit about 30 feet of nylex wire hung over the curtain rail, and an eart on to the water pipe. Under these conditions, I picked up distinctly and separately 59 different stations in one night, over 30 of them on the loudspeaker.

The speaker is housed in a detachable lid, about 2¼in deep, into which can also be packed a pair of "commando" phones and a coil of wire for aerial and earth. The speaker transformer is on the chassis and leads out to a socket on the panel, into which can be plugged the voice coil leads or the low impedance phones. A double circuit jack is also included for high impedance phones.

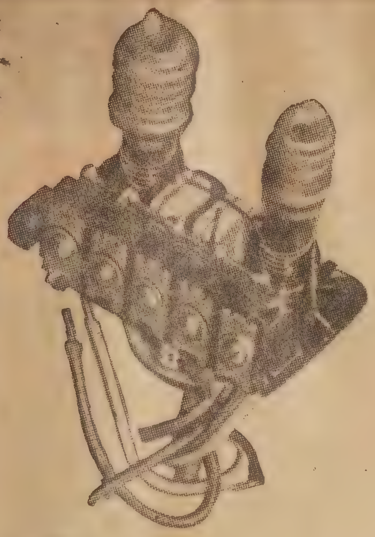
The loop is wound on the outside of the box. I had trouble with the reaction in the early stages, but achieved success with the circuit shown. The detector coil is a commercial RF coil with reaction.

The RF gain control works efficiently and is necessary when operating with phones. An audio volume control proved useless because of overloading in the early stages. (From H. J. Scott, 495 George-street, Fitzroy, N6.)

TRY THIS VALVELESS AMPLIFIER



FROM Mr. M. Herman, of Melbourne, comes this suggestion for a valveless amplifier, which he has applied to crystal sets with apparent success. The quality of reproduction is naturally limited, but it is an interesting project for the beginner who likes making things. The signal to be amplified is fed to a conventional 2000 ohm earphone, with diaphragm removed. A reed carrying a soft iron armature is brought close to the pole piece of the earphone, being adjusted for maximum signal strength by means of the adjusting knob. The crystal set should be tuned to a station, using the earphones in the usual way. The output is then transferred to the single earpiece and the phones connected as shown to the microphone and battery. The reed is then adjusted for best results. (M. Herman, 6 Nicholson-street, South Yarra, SE1, Melbourne.)



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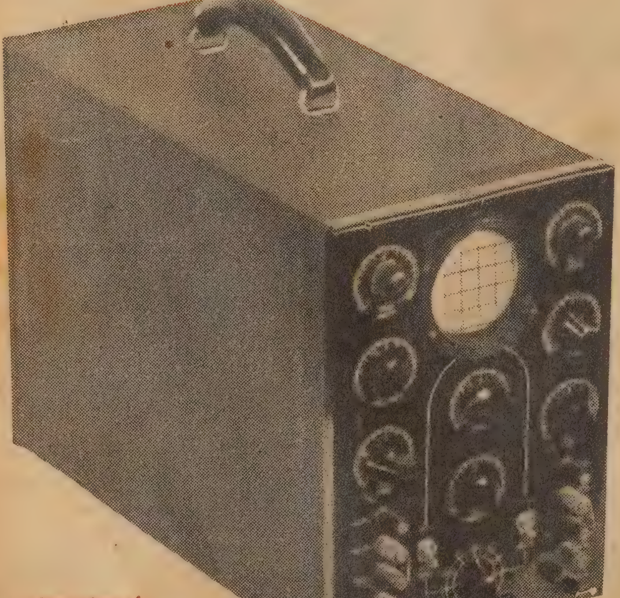
Building a Cathode Ray Oscilloscope

The release of cathode-ray tubes at very low prices has brought the cathode-ray oscillograph within the reach of amateurs and enthusiasts generally. This is the first of a series of articles we propose to publish covering the design, the construction and the application of cathode-ray equipment. This month, we describe a conventional 3-inch instrument; next month i will be one for the larger 5-inch tubes, with various other special features.



A front view of the CRO described in this article.

THE broad principles of the ca ode ray tube itself are fa well known, and it is not conside necessary to explain at any gr length, just here, the physical c struction of this most intriguing yice. Sufficient to say that its p purpose in life is to render electr phenomena visible, and this it d in a most efficient manner.

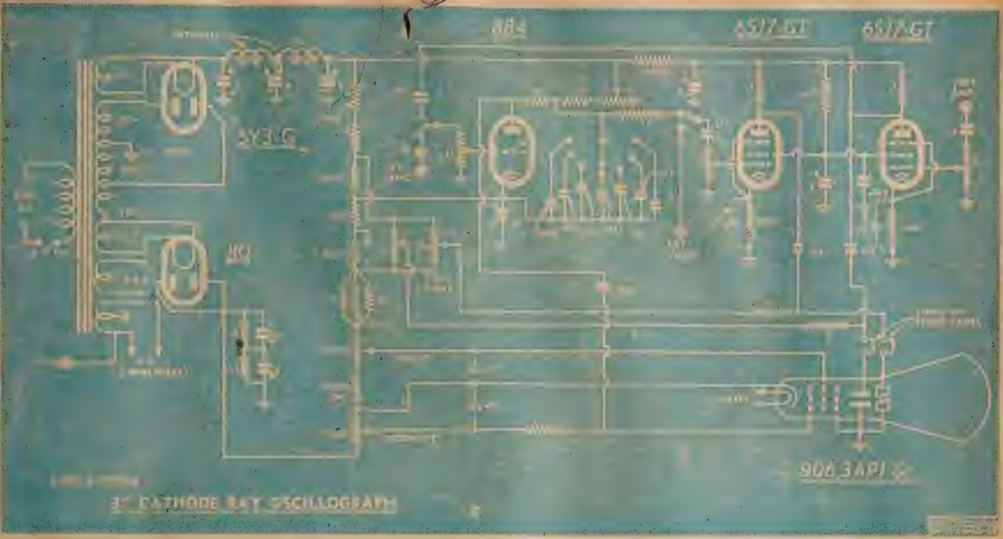
At the small end of the tube i conventional cathode, which p duces a supply of electrons. A me shell around the cathode directs electron stream forward, where comes under the influence and c trol of other electrodes in the tu

THE GRID

First of these is a grid, the purp of which is to control the number electrons passing out from cathode assembly. The grid has minimum effect on the elect stream when it has the same pot tial as the cathode, but making negative reduces the number of el trons available.

In a complete oscillograph, potential on this grid is always m variable with respect to cathode, the potentiometer is marked app priately as "Intensity" control. its agency the trace of the can be made very bright, or redu progressively to vanishing point cutting off the supply of elect

Once past the grid, the electr pass through a number of cylindr



This circuit can be considered as a standard for use with tubes of 3" diameter. Larger tubes may require the use of push-pull deflection circuits.

electrodes, which operate at progressively higher positive voltages with respect to cathode. These electrodes or anodes are so placed that they do not collect many electrons, but they tend to accelerate and focus the electron stream on its journey towards the large end of the tube, which carries the screen.

The number and placement of these high voltage electrodes depends on the nature of the tube, as also do the operating potentials. But the potential on one of them is always made variable, by means of a potentiometer, to allow the electron beam to be focused to a pin point where it strikes the display screen. The control is mounted on the front of the instrument and marked—again appropriately—as "Focus."

THE "GUN"

The complete assembly—cathode, grid and focussing electrodes — is known as the "gun," for reasons which are fairly obvious. Its whole purpose is to shoot a finely focused beam of electrons forward to the display screen.

This screen, by the way, is a thin layer of fluorescent material, which is deposited by suitable means on to the inner surface of the tube end. It is normally white, but glows brightly at any point where it is bombarded by a stream of electrons.

Most cathode ray tubes used for laboratory work have a medium persistence screen material, which gives a green trace. The "medium persistence" characteristic signifies that the trace does not fade immediately the electron stream passes on, but lingers just long enough to allow a low frequency waveform to build up without excessive flicker. Some screens give a short persistence blue trace, which is rather better for photographic purposes.

Some radar equipment used long persistence screens, in which the trace remains visible for some time after the excitation is removed. These are less useful for laboratory work, since the long persistence characteristic often confuses the picture under examination.

In physical size, cathode ray tubes may vary from something no larger than an ordinary receiving tube, to a device which comes packed in a very bulky crate. The tiny 913 is in a metal envelope and looks for all the world like a metal 6L6, except for the 1in. glass screen in the top end. These were very popular with amateurs before the war and gave a useful picture, especially when magnified optically with a reading glass.

TUBE TYPES

Later, both American and European manufacturers came to light with more conventional tubes with screens from 1⅜in. to just over 2in. useful diameter and at a moderate price. There has always been a selection of 3in. tubes for general laboratory work and some 5in. types, all too expensive for the amateu enthusiast.

by W. N. Williams

But the aftermath of war has changed all this. Many readers have succeeded in buying brand new 2in tubes of one type or another for a pound or so, and there are hundreds of 5in. types being sold, and still to be released, for a few shillings more. Even some 12in. tubes, which must have cost the respective Governments a small fortune were sold off for £1 each—but more of these anon.

This present series of articles will have served its purpose if it makes possible the translation of these sundry tubes from the carton to a complete instrument.

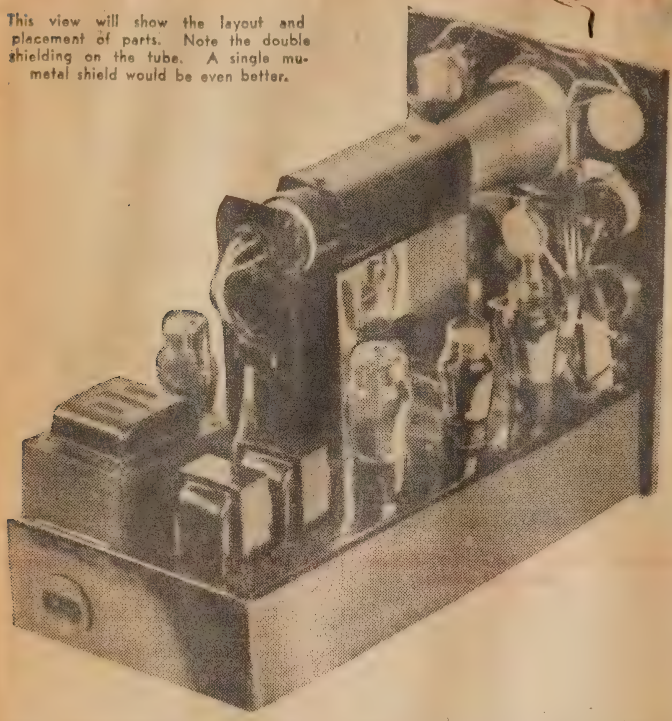
CIRCUITS

Indeed a complete cathode ray oscillograph involves quite a lot o equipment and work if it is to b truly versatile in its application. A simple modulation checker, such a we have already described, in previous issues, is a good beginning, bu inevitably the day will come whe the constructor will want to add al the necessary paraphernalia to transform it into a complete item of tes equipment.

Cathode ray valves draw very littl current, but do require comparatively high voltages for their operation. Broadly speaking, the operating voltage increases with physica size, rising progressively from abou 400 volts for the tiny 913, to severa thousands of volts for the larg types.

The voltages are not particularl critical, and tubes will work over a range of voltage almost 2:1. How-

REAR VIEW OF THE OSCILLOSC



This view will show the layout and placement of parts. Note the double shielding on the tube. A single mu-metal shield would be even better.

ever, there is a definite minimum requirement for each tube and attempts to operate it below this minimum figure will not permit a clearly focused trace to be obtained. Voltages nearer the maximum rating improve the quality of the trace, but naturally multiply power supply problems and also render the tube rather less sensitive as a voltage or current indicator.

The matter of voltage requirement is quite important from an amateur's point of view. It is all very well to possess and admire a 12in. tube, but it is rather useless unless one can organise a supply of several thousand volths to produce the required spot. Even the more modest 5in. tubes have their supply problems.

DEFLECTION

Another point of importance is the method of deflection for the electron beam.

The "gun" merely projects a fine beam of electrons on to the screen to produce a single spot, and means have to be arranged to swing the spot across the screen, horizontally and vertically, so that it will mean something to the observer.

This is most frequently accomplished by mounting two pairs of flat plates—one set horizontally, the other vertically—just beyond the end of the electron gun. A positive charge on any plate tends to attract, or bend the electron stream towards it, so that the point of impact on the screen is shifted. A negative charge has the opposite effect.

If the charge is steady, the displacement of the spot is constant. If the charge on the respective plates varies periodically, as with an alternating voltage, so will the spot be swept to and fro. The rapidity of its movement, the degree of displacement and the pattern ultimately traced out by it depends on the deflection voltages applied. As might be expected this is known as electrostatic deflection.

ELECTROMAGNETIC TUBES

The alternative method, electromagnetic deflection, requires the installation of specially designed coils around the neck of the tube, and is a method not widely used in cathode ray test equipment. Readers who have bought large tubes without deflector plates built in, may therefore find them of very limited use.

So much then for the tubes themselves. When it comes to building a complete oscillograph, one has to consider the provision of a variety of auxiliary circuits, the general lines of which have become standardised by long years of practical experience. There is thus a certain "sameness" about oscillographs, their individual virtues and vices being dependant on the limitations of the designer and the price to which the instrument is built.

The first obvious requirement is for a power supply for the C.R. tube and for the associated circuits. The arrangement of the C.R. tube supply raises an interesting point, namely its polarity with respect to chassis.

The deflector plates in the tube must return to the same general potential as the final anode, which may be positive by anything from several hundred to several thousand volts. Since access may be required to the plates for measurement purposes, it is usual to operate them at near-earth potential and to place the cathode and grid structures negative with respect to chassis by the full supply potential. In other words, the negative rather than the positive end of the supply is earthed.

The auxiliary circuits require about 400 volts at up to 20 milliamps for their supply, and with the negative side grounded in the usual way. Because of these conflicting requirements, it is therefore usual to provide independent supplies for the C.R. tube and its ancillaries, in all but the most elementary instruments.

POWER TRANSFORMER

A commonly used circuit arrangement involves a power transformer in which one side of the high voltage secondary winding is extended to a figure well in excess of its usual voltage. The normal secondary winding, in conjunction with a rectifier and a conventional filter system, provides about 400 volts at 20 odd milliamps for the auxiliary circuits.

A second rectifier valve, operated from a separate filament winding, is connected to the high voltage leg of the secondary to constitute a half-wave rectifier circuit. Since the current drain of the C.R. tube and its supply network is very small, it is seldom necessary to use anything more than a single condenser for the filter.

For supply voltages up to about 1000, it is possible to use ordinary transformer technique, and even make do with an 80 or 5Y3-G rectifier and low voltage condensers in series. But beyond 1000 volts these hard-worked components cease to be of much use and special attention must be given to components and wiring methods to avoid risk of breakdown.

R.F. SUPPLIES

For higher voltages, the so-called R.F. power supply has interesting possibilities. A valve like the 6V6-G is operated as an R. F. oscillator and a special secondary winding, with a suitably large numbers of turns, is mounted close to the "tank" coil. A high R.F. voltage is induced across this winding, which is then rectified and filtered in the usual way.

The use of a radio frequency voltage allows a simple air-cored transformer to be used and also simplifies the filter circuit. However, the main power supply must be enlarged to meet the requirements of the R.F. oscillator valve and, generally speaking, the method is of debatable virtue for moderate voltages.

Careful shielding and filtering would be necessary, in any case, to prevent the R.F. voltage from pene-

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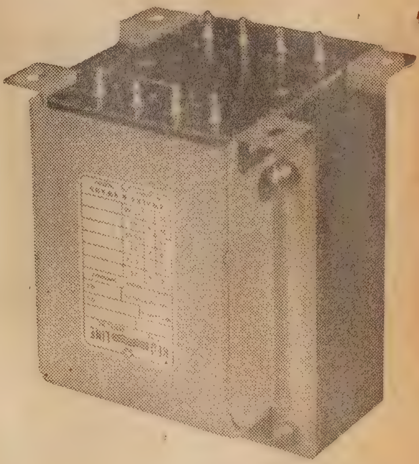

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★ *as described by Mr. D. T. N. Williamson in "Wireless World," April and May, 1947.*

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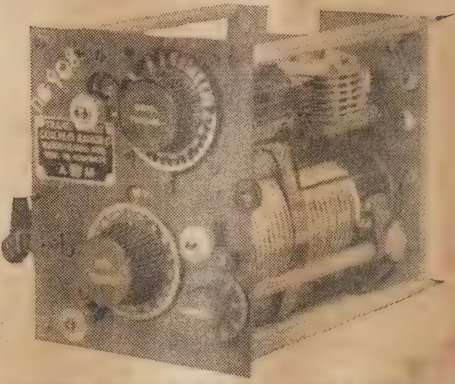

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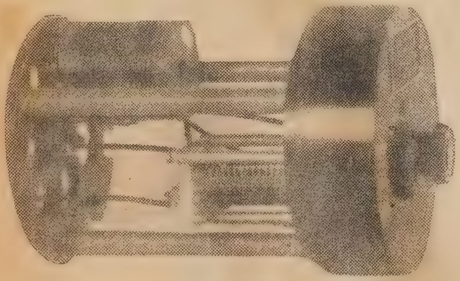

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trating the deflection circuits and compromising the focus.

The actual location of the 50 cycle power supply is a problem. For convenience it is best placed on the same chassis as the C.R. tube, so that the whole instrument is self-contained. However, the alternating magnetic field surrounding a 50 cycle power transformer is extensive and will almost certainly have some effect on the trace.

If no precautions are taken, the leakage field can easily be severe enough to produce from half to one inch deflection on the screen, so that no amount of focusing will produce a spot.

To minimise this trouble, the power transformer should be wound to operate at a very low flux density and be no larger physically than necessary. Special shielding to confine the field is also a help.

TRANSFORMER MOUNT

The transformer should then be mounted behind the tube and well away from the gun. Experiment, if possible to find the best mounting position for it. It is difficult to make general statements about mounting methods, as the effects of the field are generally random and therefore best treated by individual experiment.

The chances are that even very careful transformer design and layout will not eliminate entirely magnetic effects, and it is usually necessary to instal a magnetic shield around the neck of the tube as a further precaution. Ordinary sheet metal shields bent up from mild steel are not very satisfactory, their tendency being to modify the magnetic defocusing rather than to eliminate it.

If nothing better is available, fair results can often be obtained by slipping a length of heavy gauge water pipe over the neck of the tube, with an outer shell of sheet steel and brackets to hold it in place.

By far the best material is a shield of mu-metal which, though not impressive to look at, is far more effective than a substantial thickness of ordinary iron or steel.

FOCUSING

Broadly speaking, magnetic defocusing problems become more difficult with large tubes and, indeed, only the most elaborate precautions will allow completely satisfactory results from a 5in. instrument with built-in power supply. There is good argument, therefore, in high quality instruments, for building the power supply on an entirely separate chassis, mounted a couple of feet away from the tube itself.

The main instrument should be mounted in a metal case as a precaution against other stray fields, as well as for portability and physical protection of the cathode ray tube.

It is interesting to note in passing, that the initial position for the spot may not be exactly central on the screen, owing to misalignment of the electrodes in the tube. To correct this possible fault, it is usual to provide spot shift controls which vary the initial d-c potentials on the deflector plates by a small amount. In smaller tubes it is sufficient to vary the initial potential on one plate only of each pair. However, more complicated circuits are sometimes used for larger tubes to place a negative potential on one plate as the other is made positive.

For the examination of waveforms, a substantial voltage is required to swing the spot to and fro across the screen, so that it is usual to provide amplifiers for both vertical and horizontal deflection. Thus, all but the largest signals are fed into the amplifiers and thence to the respective deflector plates. The amplifier gain controls then serve conveniently to adjust the length and height of the pattern on the screen.

RESISTANCE COUPLING

In most cases, the amplifier is a resistance coupled pentode stage, giving a gain of between 50 and 100 times. It is usual to select values and to wire the stage so that it will have the widest possible frequency response. In fact, where the instrument is to be used for other than purely audio work, designers favor the newer high transconductance tubes and operating conditions not unlike those seen in television equipment.

For tubes up to 3in. diameter, it is normally sufficient to use a single amplifier stage for vertical and for horizontal deflection, the output of each amplifier being fed only to one deflector plate. The second plate of each pair is returned to the final anode and to earth. When the active deflector plate is positive, it attracts to beam, while a negative potential repels the beam.

DEFLECTION

Single-sided deflection is less favorable for larger tubes, as it tends to have a defocusing effect on the beam near the extremes of travel. Much better results are obtained by using push-pull deflection, in which both deflector plates are active and receive out-of-phase signals from a push-pull amplifier. This, of course, complicates considerably the whole system, requiring duplication of the amplifier stages and the provision of a suitable phase inversion circuit to feed the push-pull grids.

The designer and constructor must therefore choose between the added complication on the one hand and the improved results it affords with regard to clarity of the trace.

TIME BASE

Complete instruments are invariably provided with a time base or sweep oscillator, to use alternative terms. This device provides a sawtooth shaped waveform, which is applied normally to the horizontal amplifier and deflector plates. The peculiar waveform moves the spot evenly across the screen, from left

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to right, then flicks it quickly back to the starting point to begin a new excursion. The output from the oscillator must be consistent at all settings but variable in frequency from a few cycles to a frequency comparable with the highest signal frequency likely to be examined.

The conventional time base circuit has used a gaseous triode valve, which operates very well over the whole audio spectrum and usefully into the supersonic range. Thereafter, the waveform departs noticeably from the required saw-tooth effect and other circuit arrangements become necessary.

Various hard valve time bases have been featured in technical publications, some with excellent performance, but nearly all more complicated than the simple gas triode circuit—hence the popularity of the latter.

OSCILLATOR CIRCUIT

Quite recently, a comparatively simple circuit has been evolved using a single high-slope RF pentode and the negative transconductance property between screen and suppressor grids.

Although somewhat more complicated than the gas triode arrangement, the circuit is distinctly interesting and will probably be discussed at length later in this series of articles.

The time base circuit involves a number of panel controls which are fairly standardised in their function. It is usual to have a "coarse" and a "fine" frequency control, and another which allows the operation of the oscillator to be synchronised to the frequency of the observed signal, or to some multiple of it. In practice, the time base frequency is brought as near correct as possible with the direct frequency controls, then locked by advancing the "Sync." control.

It is usual also to arrange a switching or terminal system to allow the sweep oscillator to be locked in with an external signal or, yet again, to transfer the horizontal amplifier grid from the time base output to an external signal source.

OUR CIRCUIT

A practical illustration of all these points is given in the photographs and circuit of a 3" oscillograph, which has been in use in our own laboratory for many years. Though designed expressly for the American 906 type tube, the general circuit is applicable to all tubes with from 2" to 3" screens. In fact, the high tension voltage is nearer the mark for 2" tubes than for the latest 3" types.

In the light of the foregoing discussion, the purpose of the panel controls will not be difficult to follow.

The potentiometer in the upper left hand corner, looking on the front panel, is for vertical spot shift, allowing the initial position of the spot to be moved up or down as necessary. Beneath that is the intensity control and below that again the gain control for the vertical amplifier.

There are five terminals in line in the lower left corner. The top terminal is simply connected to a filament winding and provides a ready source of 50 cycle a-c. This can be fed to the vertical amplifier for checking purposes or to the sweep oscillator for 50 cycle synchronisation.

The second terminal connects directly to one vertical deflector plate, so that either high voltage a-c or d-c can be fed to it for observation or measurement purposes. Then comes the vertical amplifier output terminal, the vertical amplifier input, and earth at the bottom. In the normal way, the vertical amplifier output terminal is bridged across to the vertical deflector plate by a shorting link. Removing the link makes available the amplifier stage for separate use.

Down the right hand side of the panel is the horizontal spot shift, the focus control and the horizontal gain control. The topmost terminal is for the insertion of an external voltage for sweep oscillator synchronisation. The other terminals correspond to those on the left of the panel, except that they relate to the horizontal amplifier and deflector plate.

SYNCHRONISING

The potentiometer immediately below the tube face is the synchronisation control, under that the fine sweep frequency potentiometer, with the coarse frequency switch below it.

The toggle switch on the left, switches the sweep oscillator from internal to external sweep, while the one on the right switches the horizontal amplifier grid from the sweep circuit to the amplifier input terminal.

This general arrangement of the controls has proved very satisfactory for laboratory work and there appears to be little point in departing from it for any comparable instrument.

The remainder of the circuit and layout should be clear enough for enthusiasts likely to build this type of instrument. The whole job is built into a case measuring 12" x 8" x 16½", of crackle finished mild steel sheet. The chassis itself, is 16" long, 7½" wide and 3" deep, while the panel is just over 12" x 8", with a lip which turns back and fits over the outside of the case.

The vertical amplifier is on the right hand side of the chassis, with the gas triode behind it and the low voltage rectifier. The horizontal amplifier is at the other side, with the high voltage rectifier in the rear socket.

FILTERING

Two small chokes are included in the low voltage supply, but a single choke with higher inductance would do just as well. It is wise to use 600 volt electrolytics in both filters to give a margin of safety.

Shielding against magnetic fields is provided by a sheet metal bracket and tube, which hides a length of heavy water pipe, fitting around the neck of the CR tube. With this arrangement, spot definition is as good as can be expected from the particular type of tube and the limited supply voltage. Something nearer the maximum ratings for a 3" tube would be preferable, but the ratings and the supply position has undergone much change since the original instrument was built.

However, it does a very good job and will doubtless continue to do so, for many years to come.

Next month we hope to present complete design details for another oscillograph, this time using a 5" tube and a hard valve time base.

A HIGH FIDELITY AMPLIFIER

(Continued from Page 31)

at 13,000cs. On a speaker load the output was practically constant from 20 to 13,000cs., using a Goodmans 12in. speaker, although the speaker was showing signs of frequency doubling with an input of 20cs., as would be expected. As a matter of interest the resonant frequency of the speaker, when used in a vented baffle, was 45cs.

It was found that harmonic distortion on the speaker load was verv similar to that on a resistive load except at low frequencies. The distortion is extremely low, however, down to a frequency of 40cs.

At the time when these tests were carried out it was not possible to perform intermodulation distortion tests, but these will be carried out and published at the earliest opportunity. It is obvious that the total intermodulation distortion will be very low, and the tests are only intended to form a basis of comparison with other amplifiers.

This amplifier is by far the best which we have ever tested and we wish to give full credit to the original designer. It not only gives extraordinary linearity and lack of harmonic or intermodulation distortion but is comparatively simple and involves no special problems except the choice of output transformer. Unless the latter is specially designed for this circuit, or is one having extraordinarily low leakage inductance and exceptionally high primary inductance (such as the Goodmans transformers referred to in the article), the best results cannot be achieved.

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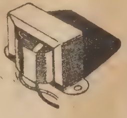

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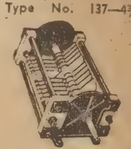

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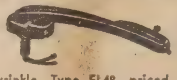

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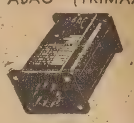

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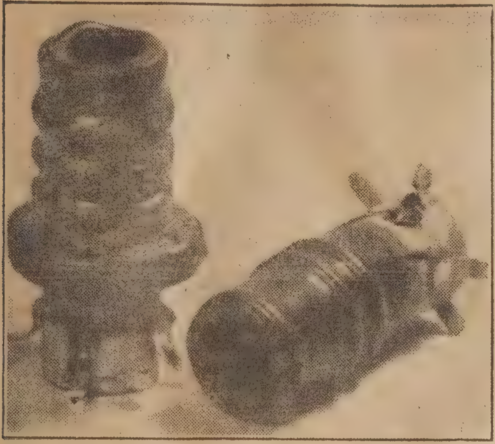


Typical modern tuning coils for broadcast receivers.

WHAT IS A TUNING COIL?

Every radio receiver contains one or more tuning coils, which have an important bearing on the operation of the set. Here are a few random facts about tuning coils and their properties.

COILS can alternatively be referred to as inductors and their electrical property is expressed as inductance. The unit of inductance is the henry, and the smaller units are millihenries and microhenries, representing, respectively, one thousandth and one millionth of a henry. Thus the electrical size of a coil can be expressed, for example, as 100 millihenries.

OPPOSES FLOW

The property of inductance tends to impede the flow of alternating current through the coil in much the same manner as a resistor impedes the flow of current. The extent to which the flow of current is impeded is measured in terms of inductive reactance, which varies with frequency and is expressed as ohms.

Apart from their inductive properties all coils have a certain amount of resistance. The d-c resistance of the wire is generally so low as to be negligible. The R.F. resistance, however, is of a higher order and it is this property which governs the overall efficiency of the coil, particularly when it forms part of a tuned circuit.

OUTSIDE SURFACE

In engineering circles, the term "Q" is used to express the efficiency of a coil. Mathematically, it is simply the ratio of inductive reactance to R.F. resistance.

Radio frequency currents tend to flow along the outside surfaces of wire rather than through the centre. For this reason the R.F. resistance of a coil is partly a function of the surface area of the wire used. Thus the "Q" factor or efficiency of a coil can be increased by winding it with heavier wire, but this naturally may involve problems of coil dimensions.

To avoid this difficulty, coils are often wound with a specially-stranded conductor known as litz wire.

Another method of improving the "Q" factor, applied either to solid wire or Litz coils, is to us an iron core inside the coil former.

IRON CORES

The iron core is a moulded composition containing a high percentage of highly magnetic particles. The particles are so small as to be considered as a dust of magnetic material and the composition is sometimes referred to as a "dust core."

The introduction of this highly magnetic material into the centre of a coil increases the effective inductance by a considerable amount. For a given value of inductance, therefore, the number of turns on the coil can be reduced, thus reducing also the R.F. resistance.

As a result, the "Q" of iron-cored coils is generally higher than similar coils with an air core. Iron-cored coils are widely used in present-day radio manufacture because of this higher "Q" property and the attendant reduction in physical size of the coil.

ABOUT REACTION

In small regenerative receivers a third winding is employed to enable oscillation to take place in the detector. This winding is known as the reaction winding. The famous old term "tickler coil" dropped out of use in the prewar years.

As in the case of the primary and grid windings, correct connection of the reaction coil is necessary to ensure oscillation.

In one type of valve regeneration, a variable condenser is connected in series with the reaction winding. At a particular setting of the condenser sufficient current will flow through the coil to introduce the necessary energy into the grid circuit and set up oscillations.

Thus, variation of the capacitance in series with the reaction winding allows the detector to be brought into or out of oscillation at will. Practical considerations govern capacitance value of the reaction condenser. If it is too small, the degree of control is insufficient, and the number of turns and the degree of coupling with the grid coil becomes very critical. If the value of capacitance is too large, small movements of the condenser will cause large changes in the current flowing in the reaction circuit, and the setting of the condenser for satisfactory reaction will be very critical.

SCREEN VOLTAGE

In another type of regeneration, the reaction condenser is a fixed value, and control over the feedback is achieved by varying the screen grid voltage of the valve.

Variation of the screen voltage governs the amplification of valve and, as a result, the amount of energy fed to the reaction winding.

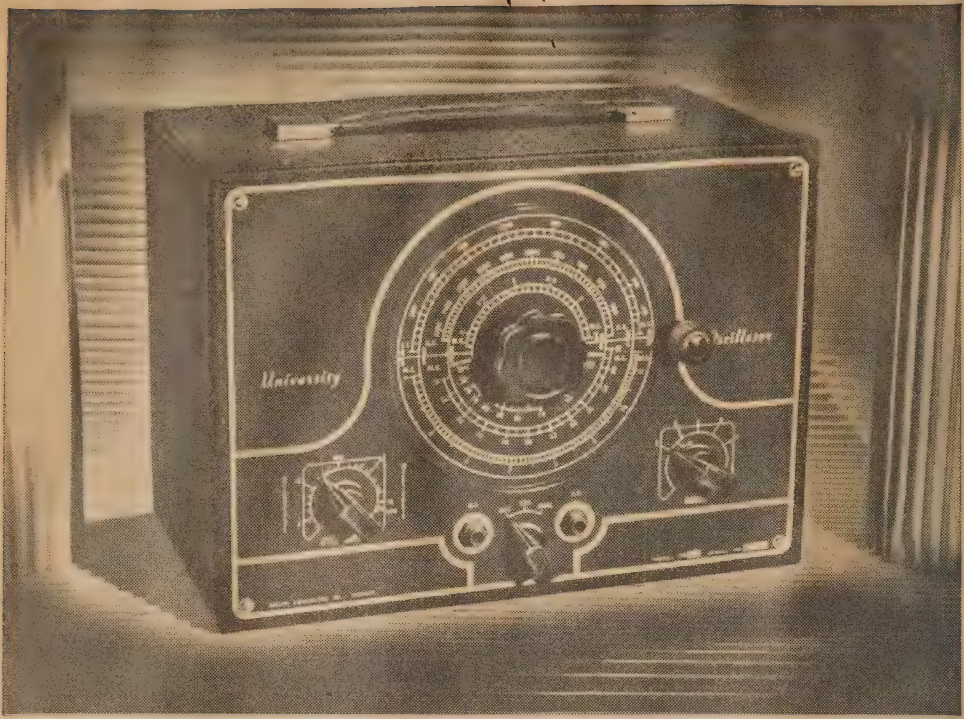
The amplification provided by a valve and its associated circuit when just on the verge of oscillation is many times greater than when it is operating without regeneration. This fundamentally is the reason why regenerative detectors have always been, and still are, very popular with the small set enthusiasts, particularly when used for short-wave reception.

A point which must be borne in mind is that an oscillating detector coupled to an aerial can cause annoying interference in other radio sets in the vicinity. This is brought about by the fact that, when the detector is oscillating, radiation takes place from the aerial at the frequency to which the set is tuned. This radiation, when "picked up" by nearby sets tuned to the same station, manifests itself by a heterodyne whistle or squeal.

AVOID OSCILLATION

The owner of a small set should therefore be most careful to avoid operation with the detector actually oscillating. Set the reaction control to a point where the detector is just below oscillation.

(Continued on Page 83)



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The new oscillator has continuous band coverage from 160 kilocycles to 32 megacycles. The accuracy of calibration is plus or minus 1% and most important of all the attenuator has negligible effect of frequency on all bands and at all attenuator settings.

The attenuator is calibrated in microvolts and millivolts and the output is from approximately 5 microvolts to .1 of a volt.

This new improved attenuator is something that makes the oscillator outstanding in its class. It is a variable capacity piston attenuator with an approximately logarithmic scale calibrated directly in microvolts and millivolts.

A convenient switch located on the striking, dark red front panel has three settings:—
(1) An off position which means that the filaments of the oscillator are alive so that at a flick of the switch the signal is generated immediately.
(2) Providing an unmodulated R.F. carrier wave and
(3) Providing a modulated carrier wave modulated at 400 cycles.

The instrument is in a handy size of 11¾" x 8½" x 7½" and has a total unpacked weight of 17½lbs. It is finished in black brocade and is fitted with a flat carrying handle. The panel is outstanding in the new "University" colour of dark red with clear nickel plated raised markings.
The instrument comes to you complete with valves and shielded output leads.
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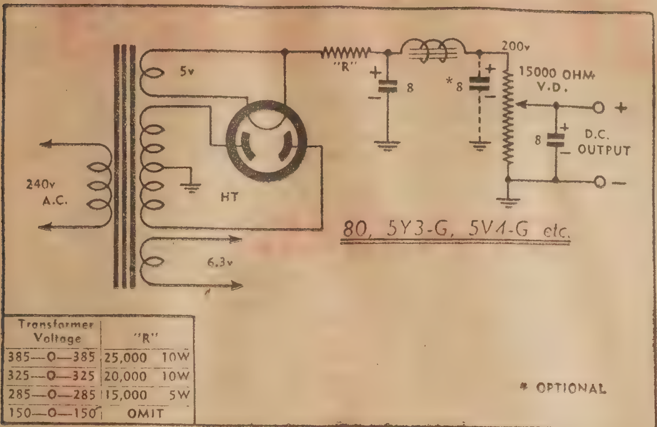

Transformer Voltage	"R"
385—0—385	25,000 10W
325—0—325	20,000 10W
285—0—285	15,000 5W
150—0—150	OMIT

Circuit for the eliminator and transformer chart.

With a power transformer, rectifier, a choke and a couple of resistors and condensers, the beginner can make up an eliminator unit to replace the B-battery for a small set. The following article explains the principle of eliminators and suggests means of using oddment parts.

The constructor can please himself just what physical form the unit takes, the main point being to avoid short circuits and so to enclose the wiring and components that there is no chance of accidental contact with the high tension circuit.

It is first necessary to rectify the alternating current—i.e., make it all flow in the one direction—and then to filter it into smooth direct current before finally applying it to the plates of the valves in the set.

A transformer is necessary because we want a fairly low voltage to heat the filaments of the rectifier and a fairly high one to be rectified and supply the high tension. Other essentials are a choke and condensers, which help with the smoothing, and one or more resistors to adjust the voltage to the required value.

TRANSFORMER WINDINGS

Radio power transformers usually have a primary and three secondary windings. The high voltage secondary is provided with a centre tap which is connected to earth and provides the negative terminal of the power supply. The other two wires go to the plates of the full wave rectifier.

A low voltage at relatively high current is provided by the two remaining windings. These are used, one to heat the filament of the rectifier valve and the other to heat the filaments of the other valves in the set, if these should be for a-c operation. In a case where the unit is being used with a battery set, this latter winding is simply left disconnected.

Since many transformers have no markings to identify the windings, some remarks on the subject would not go astray. In such cases, the primary windings and the high voltage secondary are usually brought out with multistrand fine wire, protected by spaghetti insulation. These can be identified in a simple continuity test by the fact that the secondary has three and the primary only two connections. The secondary also has higher d-c resistance..

IDENTIFICATION

If no AC voltmeter is available, the two low voltage windings can be identified by connecting the primary to the mains and then trying a dial lamp across each winding in turn. The winding giving the greatest brilliance from the lamp will be the 6.3v and the other the 5v winding.

A word of warning is timely at this juncture. The high voltage winding is dangerous, and great care is essential if a very nasty shock is to be avoided. Tape the ends of the leads with insulation tape while making this test, to be on the safe side. There will in all probability be another lead to account for. This will be the electrostatic shield, and is simply connected to earth.

A full explanation of rectification is beyond the scope of this article, but it will suffice to say that a pulsating direct current appears at the filament or cathode of the rectifier valve.

SMOOTHING

The next job is to smooth this current and make it suitable for application to the set. This is where the choke and condensers come in. A glance at the accompanying circuit will verify that the current has to flow through the choke on its way to the set. Also a condenser is connected from the rectifier filament to earth. The choke, while allowing easy passage to direct current, resists the flow of any ripple which may be present.

The condenser, on the other hand, will not allow direct current to flow but stores the power when the voltage rises, and delivers it again when the voltage tends to fall. Another condenser is sometimes placed at the other end of the choke to complete the job of filtering.

In the case of small battery sets, the full high-tension voltage available from such a supply as this is not needed, so that resistances are employed to drop it to the required value. Just how this is done can be seen by referring again to the circuit.

FILTER CONDENSERS

Another point about the power supply is that, although it must provide a high d-c potential, there must be an easy path to earth for alternating current. This condition is met by connecting a condenser between the high tension of the set and earth.

While on the subject of condensers, it is most important that those of the electrolytic variety be connected into the circuit the correct way round. The positive end is usually marked on the diagrams and shown in red on the condenser itself.

We have included a resistor, marked "R," the value of which depends on the high tension voltage delivered by the transformer. A table showing this value for various transformers is given. The purpose of this resistor is to adjust the voltage, so that 200v is available across the voltage dividing resistor. The latter is essentially a former about 1in. in diameter and 5in. long, wound with resistance wire. It is provided with one or more sliding clips, which enable the required voltage to be picked off. In this case, if the tap was moved half way up the divider, roughly 100v will be measured between the tap and earth, and so on. It is a matter of applying simple proportion.

OUTPUT VOLTAGE

The exact voltage obtained will depend to some extent on the current drain of the receiver, but the above is given as a rule of thumb

(Continued on Page 83)

Experts say that the earth has about five or six million tons of coal, four thousand million tons of oil, and water power estimated at 472 million hp.

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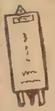

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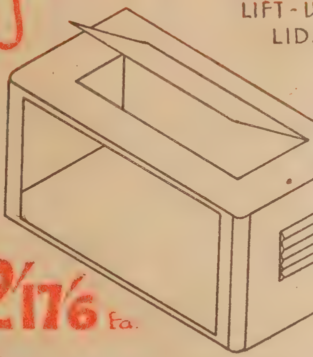

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I should like to express my appreciation for the circulars and technical notes, which I have received periodically; these are interesting and enlightening. As I am only now commencing to make radio a hobby, these will be very useful.
J.W.B., Lawson, N.S.W.

I would like to commend your excellent service, both as regards speed, and your circulars and circuits. Your organisation is greatly admired by us "down south" and your circulars are very eagerly awaited.
W.J.B., Hobart W., Tas.

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D.C., Ryde, N.S.W.

All my radio goods arrived in excellent condition. Thank you for your very speedy and efficient service.
J.A., Bathurst, N.S.W.

Would you please continue to send me your "Technical Notes" which I find very interesting.
W.C., Brunswick, Vic.

May I also express my appreciation of your technical literature which I receive.
C.W.B., Taralger, N.S.W.

I wish to thank you for your "Technical Notes" which I have received regularly. They are very interesting.
W.B., Maryborough, Qld.

I find your technical notes and hints very helpful. I am a radio serviceman and look forward to them every month.
K.R.B., Shepparton, Vic.

First of all I wish to thank you very much for the very interesting literature which you have sent me from time to time.
J.R.B., Dookie, Vic.

I received your last "Bulletin" and thank you for it. They are very interesting and I am always keen to receive them.
D.D., Myrtleford, Vic.

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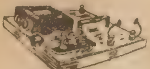

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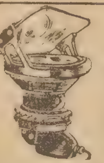

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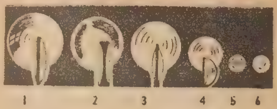

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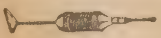

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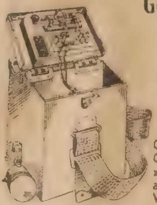

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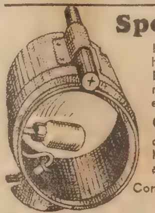

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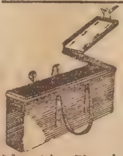

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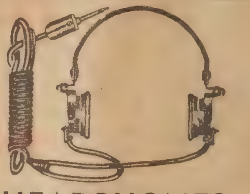

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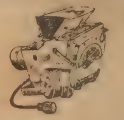

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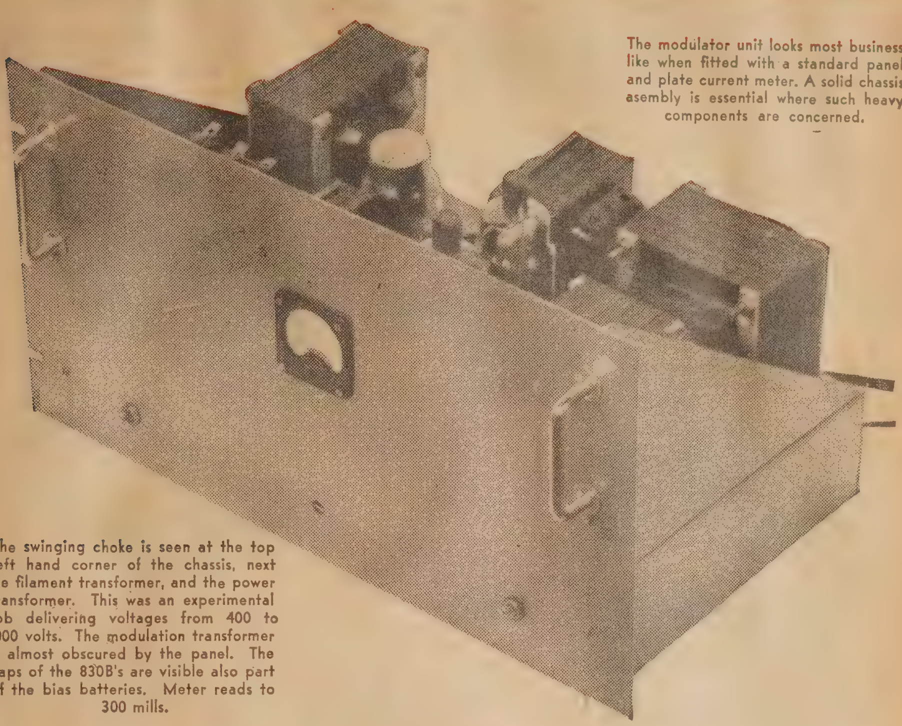


The modulator unit looks most businesslike when fitted with a standard panel and plate current meter. A solid chassis asembly is essential where such heavy components are concerned.

The swinging choke is seen at the top left hand corner of the chassis, next the filament transformer, and the power transformer. This was an experimental job delivering voltages from 400 to 1000 volts. The modulation transformer is almost obscured by the panel. The caps of the 830B's are visible also part of the bias batteries. Meter reads to 300 mills.

A "B" CLASS MODULATOR

The simplest and most economical "B" class modulator was aimed at in this design. It will give clean audio over a wide range of outputs, depending on the plate voltage used. At 600 volts, output is approximately 90 watts, and 50 watts at about 500 volts.

by John Moyle VK2JU

FOR simplicity, ease of construction and low cost, it is hard to pass over a pair of 807's in class AB2 as a modulator for a transmitter with an input of 100 watts.

Such a modulator will easily give 60 watts or so of clean output using a receiver type power transformer and choke, and is greatly favored by amateur transmitters on that account alone.

MODULATION SYSTEMS

However, there are many who still prefer a class B system, using triode output valves, and who would not desert their favorite circuit at any price. Many of these can be heard with excellent quality phone transmissions, but there are others who are not so successful.

Either of these modulation systems will work quite well, if they are properly built and adjusted. For those who are definitely "class B" minded, the release of the 830B valve for about 23/- net is indeed news. There is no valve of comparable performance available at anything like this figure, the nearest being the 811, which is in short supply at about 40/-, and the 809, which costs even more.

The 830B has a maximum output of 175 watts for the pair at 1000 volts, much more than the average amateur will require. At about 600 volts, it will give nearly 100 watts, and for a "modulator to end modulators" it is quite a proposition.

The extra reserve power, provided it is not abused, will ensure almost certain freedom from distortion at the maximum licensed input, and looks attractive for those fortunate enough to obtain a higher powered unit, which is sometimes given if the circumstances warrant it.

THE DRIVER STAGE

Another point worth remembering is that, whereas perfect power supply regulation and exact matching are needed to obtain full output without distortion, neither of these matters is quite so important if the valves are run well within themselves. While this must never be considered justification for imagining that any old line-up or components will do, it is something in favor of using a modulator conservatively operated.

This modulator has been designed to present a simple, distortionless design with all these points in mind.

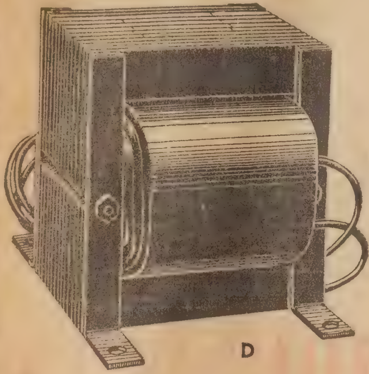
LATEST TRANSFORMER DEVELOPMENT

By Ferguson !

TYPE 6/240/U.
Transformer Type (6/240/U) has been designed for operation in a universal 240v. A.C. or 6v. vibrator power supply. Used in conjunction with a 6X5GT rectifier, the output voltage at a current drain of 60 ma is 250v. D.C. on either 240v. A.C. mains or 6v. D.C. supply. This transformer was used with outstanding results in the 6/240 Set illustrated on Page 58 of the November issue of "Radio & Hobbies." Type 6/240/U is illustrated in Block C.

FERGUSONS RADIO
WILLOUGHBY, SYDNEY

C



D

TYPE P/30.
This transformer was specially designed for the Minivox Radio illustrated in the December issue of "Radio & Hobbies." This unit is a small power transformer with good regulation, suitable for any type of set or instrument where an output of 150 volts at current drains up to 30 m.a is required. This transformer is illustrated in Block "D" and should be used in conjunction with a 6X5GT rectifier.

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TYPE.	PRIMARY.	SECONDARY.	FREQUENCY RESPONSE	RATING.
OP22.	Single 807. 3250 ohms. 85 m.a. D.C.	500/125 ohms. or 2.3 ohms.	1 db. 50 c/s-12,000 c/s	10W.
OP23.		8.4/2.1 ohms. or 12.5 ohms.	1 db. 50 c/s-12,000 c/s.	10W.

FEATURED IN THIS MONTH'S ISSUE IS A 100 WATT MODULATOR UNIT USING OUR AUDIO TRANSFORMERS TYPE IP4 driver and TYPE M125 MODULATION

LABORATORY SERVICE TO MANUFACTURERS

The Ferguson Laboratory is continually engaged in research for the improvement and advancement in the transformer and electronic field. This Laboratory together with its technical staff is available to assist manufacturers with their transformer problems.

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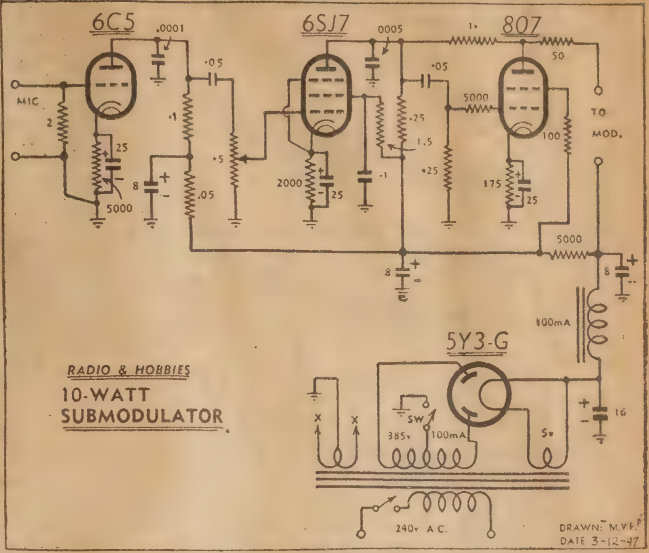
CIRCUIT OF SUB-MODULATOR



Values for the VR65A are given in the text. Any suitable triode or pentode may be used. The 807 could be replaced by a 6L6.

There should be no difficulty in obtaining the results set out here, and it is hoped that it will do something to solve the problems of many amateurs who have not been altogether successful with class B.

In general, the requirements for a class B modulator are first of all a sub-modulator or driver capable of delivering the required driving power to the grids of the class B stage, using an output arrangement having a low output impedance. Secondly, the class B stage itself must use a power supply capable of catering for a maximum current drain five or six times as great as the no-signal current without too great a variation in output voltage throughout this range. Unless these two requirements can be satisfied, success with class B is difficult.

Let us outline how we tackled these problems, explaining the various design points as we go along.

To obtain from 4 to 6 watts of power for a class B stage, and to attain the aim of low driver impedance, the standard arrangement is to use a pair of valves such as the 2A3 type in push-pull. Assuming a grid drive of 5 watts, and allowing for about 80 per cent. efficiency in the driver transformer, these valves will be required to deliver something over 6 watts as a minimum. The effective output impedance of the 2A3's is quite low, and good results may be expected from them.

The cost and availability of 2A3's, however, is against them, and we, therefore, began to examine suitable substitutes.

SIMPLICITY

A single 807 as a class A amplifier, fed with 350 plate and 275 screen volts or thereabouts will give an output of nearly 12 watts—say 10 to be on the safe side. This is ample output. The fact that the valve is normally used with inverse feedback in this type of service greatly lowers its effective output impedance, which becomes very similar to that of the triodes. It seemed, therefore, that our driver problem was to be fairly easily solved, the more so when the low price of the 807 is considered.

The need for a low output impedance in this stage is evident when we examine the load into which it is required to operate—namely, the grid circuit of the class B stage.

With no signal, the class B grid circuit draws little or no grid current, particularly in the case of valves such as the 830B, which operate with some standing bias. As soon as the signal input voltage to the stage exceeds this bias, which it does at low levels, the grids are driven positive, and begin to draw current. As the volume increases, so does the grid current, which is maximum when the stage is delivering its full output.

GRID IMPEDANCE

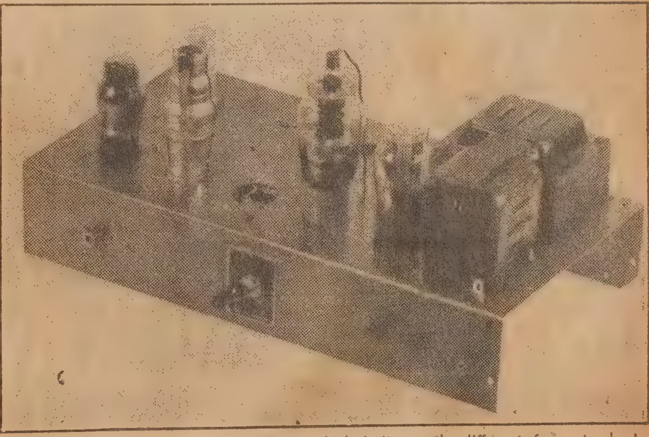
It is obvious, therefore, that the grid impedance of the stage is by no means constant. It varies from almost infinity with no input down to several thousand ohms at full output. This fact makes the examination of driver-to-grid matching exceedingly complicated. For this reason, we will not attempt an exhaustive analysis, but we can make some general statements calculated to illustrate why care is needed in this regard.

Assuming full output from the modulator, the driving power must must be handled by a transformer which will provide the correct excitation voltage at the class B grids.

The approximate grid impedance can be calculated from the driving power and the voltage delivered to the grids. If the driver transformer ratio is not correct, for this impedance, adequate driving voltage will not be attained, and in the attempt to provide extra drive to overcome this inefficiency, the driver will be overloaded, and distortion will occur.

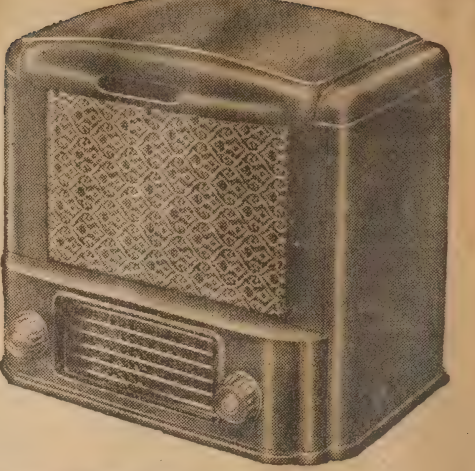
This effect will be most noticeable at maximum power output, being progressively important at lower outputs, according to the degree of mismatch.

If the above requirements are studied, it will be clear why at low modulator outputs driver transformers having appreciable mismatch will give reasonably distortionless output, but cause driver overload and inefficiency as the output is increased. It is, therefore, essential to use a properly designed transformer if your modulator is to give the output you expect, and is to do it cleanly.



A general view of the sub-modulator which isn't greatly different from standard amplifiers described in past issues.

Three Valve Triple Wave Receiver



Complete in every detail and easy to build, this new three-valve triple-wave receiver is the ideal kit set for the beginner. Only a few simple connections required.

A profusely illustrated 16-page book takes you through every interesting step in the building of this versatile kit. You get the inside story on radio when you follow the construction of the "Triple Three," because the function of all parts and sections of the design are described in detail.

Only the best quality components are included and the kit comes complete with valves, Rola 5" speaker and everything for you to construct it, right down to the last nut and bolt.

The "Triple Three" fits snugly into the famous Electronic Parts plastic cabinet. It is available for only £12 (insured, post free). Satisfaction is guaranteed because the coil unit is pre-tested.

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- ★ 4-valve B/C Battery Kit, complete with all batteries, £16/8/- (freight extra).

NOTE: Free Technical leaflet available describing each of the above kits.

New University Portable Has Built-in Loop Aerial

Here's the first portable kit with a loop aerial built right into the cabinet! Former portable kit sets featured only the conventional loop aerial. The new University PK4X, however, obtains maximum efficiency from a loop aerial first wound around the outside of the case and then covered with solid leather cabinet covering.

Price including Tax **£16/19/6**

The new PK4X kit includes all parts necessary for the construction of this ultra modern receiver. It is a 4-valve portable kit employing the latest bantam type valves and minimax type batteries.

Instructions, Easy-to-Follow

A complete book of instructions has been written for the kit and features easy-to-read text and clear photographs showing wiring diagrams and circuits. The kit is already assembled for you and wiring is simple. The clearly marked dial carries all major Australian Stations. Sensitivity and tonal quality are excellent.

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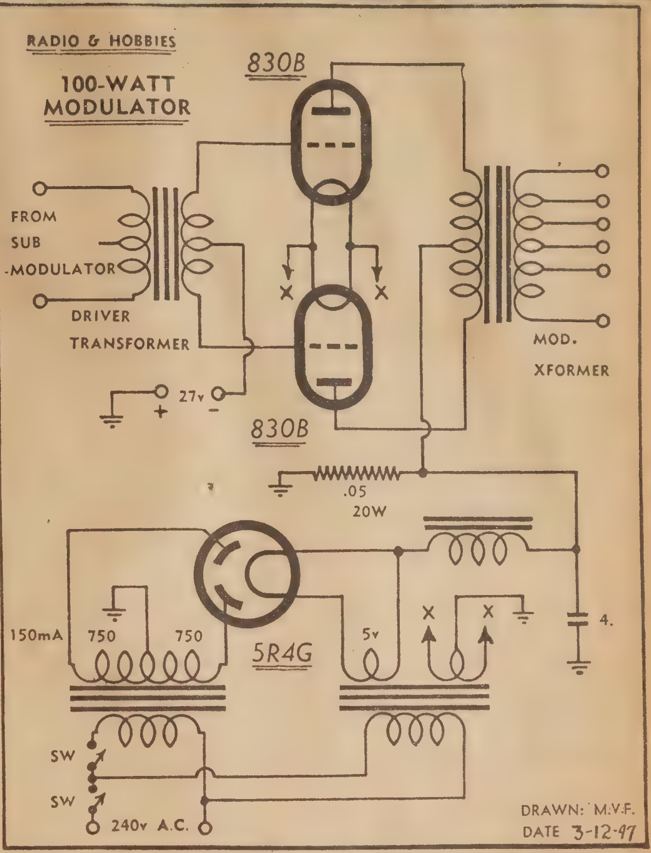
CIRCUIT OF THE MODULATOR



Circuit of the modulator showing 830B's. Alternatively 809's could be used with zero bias up to 700 volts. Taps on the driver secondary should be selected for highest output. Better regulation will be obtained by using 866A rectifiers.

DRIVER TRANSFORMER

The driver transformer we have specified, and have suggested for manufacture, has a centre-tapped primary, and a tapped secondary. This will allow its use either with the 807 or with push-pull 2A3's, should these be preferred or be already available. Our results with both driver systems were of much the same order.

Reverting to the general design of the driver or sub-modulator, we find that a triode pre-amplifier resistance coupled to a pentode will give sufficient gain when operated from the average crystal microphone. If more gain is needed, the pre-amplifier may be a pentode. Our pre-amplifier circuit is quite stable, and if the usual precautions are taken when substituting with a pentode, similar results should be obtained.

Actually we used a VR65A in the pentode socket, because it was on hand. This valve has characteristics similar to those of the 6AC7 and the EF50 for audio work. It called for a plate load of .1 meg., a screen resistor of 3 meg., and a cathode resistor of 1000 ohms. These values should be approximately correct for the other two.

These valves will give somewhat higher gain than the 6J7G; but the full gain as realised is not essential, even for outputs up to 140 watts.

DRIVER CHASSIS

The chassis used was the same as that used for earlier modulators. It was found that a single chassis for the complete outfit would be far too large to be practicable, and convenience dictated that we build the sub-modulator and modulator as two separate units. There will be extra room on the sub-modulator chassis, useful for the later addition of volume compressors, &c., should these be added. It will also accommodate a push-pull driver stage, and we have, in fact, built such a stage on another similar chassis.

There are no special precautions called for in this unit, apart from the standard injunction to keep input circuits isolated from other wiring, and to provide common earthing points for each stage. Valve-shields for the first two valves should be used.

The parasitic suppressors for the 807 may not be required, but it is good practicce to include them for safety's sake. The use of an insulated mounting-strip down the centre of the chassis is a great help in orderly wiring, although a number of components can best be mounted across the valve sockets themselves. The power supply uses standard receiver transformer and choke, and the filtering is sufficient to keep the hum level very low.

The frequency characteristics of the stage are extremely good, being essentially flat over the entire range.

MODULATOR

The modulator proper is built on a separate chassis which mounts the driver transformer, the valves, modulation transformer, high-tension transformer, filament transformer for the 830B's and the rectifier, and the swinging choke.

The plate supply for the modulator is called upon to supply currents ranging from about 30 mills to about 250 mills with as low voltage drop as possible. For ideal results, the voltage should not drop at all within this current range. To achieve this, expensive power equipment would be required, including mercury vapor rectifiers and a carefully designed swinging choke.

In designing our power supply, we considered first of all amateur requirements. Actually, our modulator voltage drops about 100 volts between no-load to full-load at an initial voltage of about 900, which we used at one stage for purposes of test.

This means that although we commenced with the potentialities of an output of, say, 170 watts, this was reduced to about 140 because of the high-tension voltage drop.

There are, however, no other very serious effects attributable to this lowered voltage. Similarly, starting with about 700 volts, we found only about 600 available at full output.

At 600 volts, however, we were obtaining about 90 watts of audio, which was plenty. We could, therefore, see no point in specifying more expensive or elaborate equipment merely to obtain extra watts we didn't require.

The main cause of this order of regulation is the high voltage drop across the rectifier. The use of 866A's would probably halve the voltage drop. However, a 5Z3, or, better still, the 5R4G, will easily handle the voltage and current drain, and cost much less than the larger valves.

REGULATION

The other causes of poor regulation are the a.c. resistance of the power transformer windings, and, of course, the design of the swinging choke. A swinging choke is one having a high inductance at low drain, but which, of course, falls in value as the current drain increases, so that

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at full output the filter becomes practically condenser input. It is this gradual change from choke to condenser input which keeps the voltage output reasonably constant. Again, almost any choke of about 20 henries and 200 mills rating will work in the circuit, although best regulation will be obtained when using a choke specifically designed for the purpose. The design of such a choke isn't easy, and it is a good plan to obtain one made by a manufacturer who has been given full details concerning its operation in the circuit.

Naturally, the hum level will be greatest at full input, where, in the absence of a second filter choke, the filtering is poorest. In practice, however, the hum will be so far below the audio output im amplitude as to be negligible for amateur work. Once again, an extra filter choke and condenser for our purpose is merely a refinement.

FILTER CONDENSER

A pair of 600-volt electrolytics of 8 or 16 mfds. capacity connected in series will serve as a filter condenser, although we used a pair of paper condensers which happened to be on hand. It is usual to parallel the electrolytics with .25-meg. resistors to help even up the voltage drop across the pair, but it is also a good plan to use two condensers which show the same capacitance and leakage current at operating voltages. These condensers should be satisfactory up to 1000 volts, remembering that they are not called upon to handle the voltage peaks from the rectifier because of the presence of the filter choke.

The specifications for the modulation transformer allow for an output of 125 watts over the useful speech frequencies. These are considered to be about 300-5000 cycles. A transformer which will show adequate reactance down to, say, 50 cycles, would be exceedingly large and expensive, and unwarranted for amateur work. As a result, do not make tests at high output on the lower frequencies. If you do, you will find the output will be practically all dissipated in the plates of the modulators, and it is quite possible to run these red hot at high inputs at, say, 50 cycles, at which frequency the reactance will be well down. Similarly, if high fidelity at the upper frequencies is attempted, a special pin-wound transformer would be needed, again rocketing the cost.

MODULATION TRANSFORMER

You will find, however, that for audio power of up to 100 watts a well-made transformer to our specifications will be splendid for speech, and again will probably end your transformer problems for many a day.

We have specified a 7000 input impedance, with output tappings from 4000 to 8000 ohms. Thus either 809's or 830B's are catered for, feeding single-ended or push-pull transmitters of almost any kind. It is seldom that impedances other than these will be required, and reasonable mismatch can be tolerated, particularly in view of the reserve power built into the design. These will, of course, be most important if ever full output is required.

The power transformer might well be one you have on hand. It should have a rating of at least 150 mills, as although peak current may be higher, average current will be lower than this figure. The better the transformer, the better will be the voltage regulation.

We have made tests with 830B's, 809's, and 811's in this modulator at various voltages. Up to about 1000 volts, the load requirements for these valves is much the same, although it differs at higher ratings with which we are not concerned. Bias requirements, however, are not the same. The 830B needs 27 volts at 750 plate, the 809 will work well with 18 volts, and the 811 needs no bias.

At voltages from 500 to about 750 effective, outputs were very similar with all three. The 809, at the higher voltages, began to show a slight kink in the wave-form indicating the need for more than cut-off bias to keep the plate dissipation down. It is not recommended for outputs of more than about 70 watts or so as against the other two valves.

Up to 100 watts, only the 809 will approach its maximum ratings, and will be the only valve to show any plate color at full output, if at all. We found color to appear only when pushed on our bench tests with steady sine wave input, when plate dissipation is highest. This is only to be expected, as under operating conditions, the valve would never be run so severely, owing to the much lower average power on voice.

STANDING CURRENT

We have shown a bleed of 50,000 ohms across the power supply. This is OK for the 830B's which run a fairly high standing current. The 809's will draw much less without signal, and a husky bleed resistor of twice this value will increase the current to about the 40 or 50 mill mark which is a good thing. It will prevent the plate volts from running too high without load, and thus adversely affecting regulation.

Tests run with the 830B's gave about 80 watts secondary output with plate voltage swinging from 640 to 520, maximum current about 160 mills. With plate volts 720-680, output was 110 watts with current peaking at 200 mills. With plate volts 980-850, output was 180 watts running to 280 mills and 32 volts bias. With about 500 volts available, output was something over 50 watts, requiring a 600 volt per side transformer. These figures will probably represent the maximum available with tolerable distortion.

The 811's are easiest to drive, but there is plenty of drive from the 807 for all three. These figures show the 830B to be the best all-round buy of them all.

Bias must be from a well-regulated source, as there is grid current flow-

(Continued on Page 92)

TRADE REVIEWS AND RELEASES

VERSATILE KITSET

Versatility is the keynote of the newly released Radaphone basic kitset. The chassis and components can be applied equally well to the construction of a 3/4 or a 4/5 valve superhet.

FOR the 3/4 valve receiver, the manufacturers actually suggest the January, 1946, version of the well known "Little General." For the 4/5 valve version, the circuit of the "Radio & Hobbies" "1947 Advance" is admirably suited. Actually, the receiver can be constructed first to the simpler circuit and modified later to the "Advance" by the addition of a valve and a few extra components.

However, there is nothing to prevent an individual constructor from following any 3/4 or 4/5 valve circuit he may fancy, as the physical layout of the major components is not likely to be affected.

The basic kitset includes the chassis, gang condenser, I.F. transformers, valve sockets, dial movement, speaker, knobs and volume control. A Bakelite cabinet, as illustrated, is also supplied, the normal color combination being a walnut cabinet, brown speaker silk and cream bars and knobs.

The receivers may be built up as straight broadcast jobs, but Radaphone Industries are arranging for the kits to be supplied alternatively with dual-wave or tri-wave brackets.

I.F. CHANNEL AT 1900kc.

Special interest centres in the Kingsley foundation kit type KF/HB. This kit employs permeability tuning of conventional pattern but is provided with a special oscillator coil and a 1900 Kc. I.F. channel. Use of this higher frequency makes possible a superhet circuit with a much wider band pass characteristic.

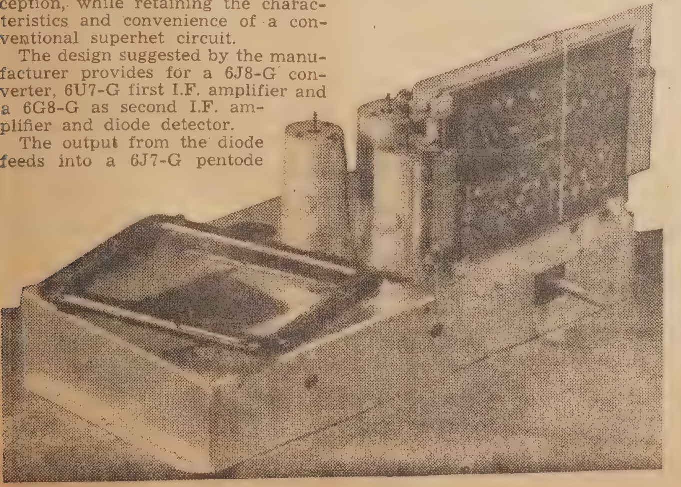
TO date, an intermediate frequency of 1900 Kc. has been employed almost exclusively in high frequency receivers, so that its application to the broadcast band is especially interistics and convenience of a confrequency is much lower than at the conventional 455 Kc. so that it is possible to achieve a selectivity curve favorable for high quality local reception, while retaining the characteristics and convenience of a conventional superhet circuit.

The design suggested by the manufacturer provides for a 6J8-G converter, 6U7-G first I.F. amplifier and a 6G8-G as second I.F. amplifier and diode detector.

The output from the diode feeds into a 6J7-G pentode audio amplifier, which is direct coupled to a 6A3 output valve. Conventional filtering is used, with a 5V4-G rectifier.

A broader band characteristic could be obtained by omitting one I.F. stage, which should still leave sufficient gain and selectivity for local reception. This type of circuit is, of course, not recommended for listeners who are more keen on receiving a large number of stations than in wide band reception of the locals.

Information and supplies of the KF/HB kit are available through Kingsley Distributors.



BOOK REVIEW

"THE PRACTICAL RADIO REFERENCE BOOK," By Roy C. Norris. Published in London by Oldham's Press. 288 pages, 250 fine illustrations.

As the title of this book indicates, it is a handbook principally for the use of radio engineers and servicemen, and contains a variety of tables, formulae and abacs relative to radio equipment design.

For ease of reference, the book is divided into chapters covering specific subjects, such as d-c calculations, alternating current, tuned circuits, filters and equalisers, wire tables, color codes, interference suppression, propagation, aerials, and so on. A comprehensive index is provided at the back.

In these days, when imported valves are about in large numbers, the special 126-page valve data section will be of special interest. This appears to be well up to date and gives data and base connections for British and American valve types.

Yet another interesting chapter gives details of test equipment, typical circuits and applications for the instruments.

Australian price for the book is approximately 13/9 plus postage. Our copy from Angus & Robertson, 89 Castlereagh-st., Sydney.

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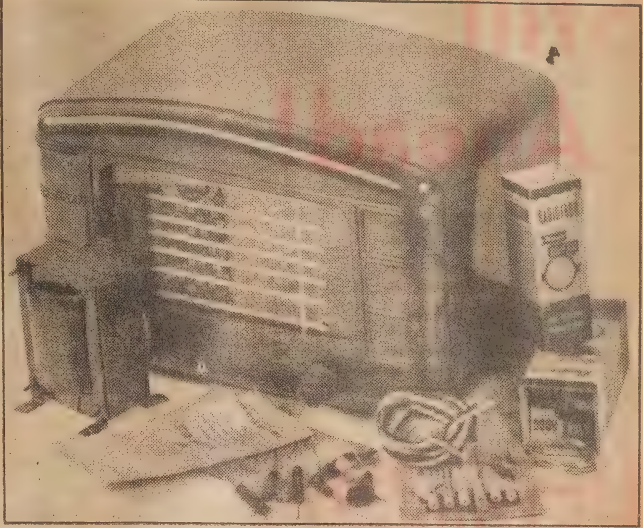
BLOCH & GERBER RELEASE "YORK" KITSET

Sure sign of the improving parts supply position is the appearance of constructional kitsets, "down to the last nut and bolt." Latest release is the "York" kitset from Bloch & Gerber.



THE kit comes packed in a cardboard carton and contains all the parts necessary to assemble, wire and complete a four valve broadcast mantel receiver. It includes the chassis, gang-condenser, speaker, coils, IF transformers, power equipment, valves and all other necessary components.

The "York" is housed in a bakelite cabinet, with a straight line dial movement and plastic face. The dial face is slotted to provide an outlet for the sound, since the loudspeaker is mounted immediately behind it.

Valve line-up is 6J8-G converter, 6G8-G IF amplifier and detector, 6V6-GT output valve and 6X5-GT rectifier. The circuit is simple and conventional and is capable of excellent results as a mantel receiver in the suburbs and near city areas. Cabinet size is 10¾in. x 6¾in. x 6½in.

Each kitset contains a full schematic circuit diagram and a set of building instructions, which would be particularly valuable for the novice. The instructions cover the sequence of steps in the initial assembly and then in the wiring. The alignment procedure is quite standard but is also set out, while instructions are given for fitting the chassis into the cabinet.

The "York" kitset retails for £13/13/-, and attractive discounts are available to trade buyers. Enquiries should be addressed directly to Bloch and Gerber, Ltd., 46-48 York-street, Sydney.

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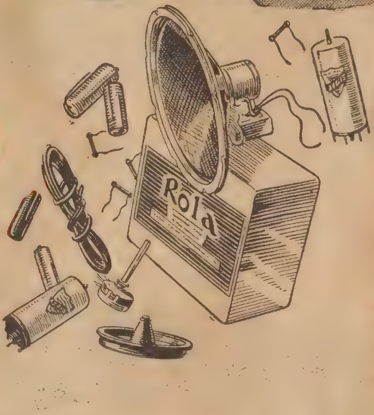

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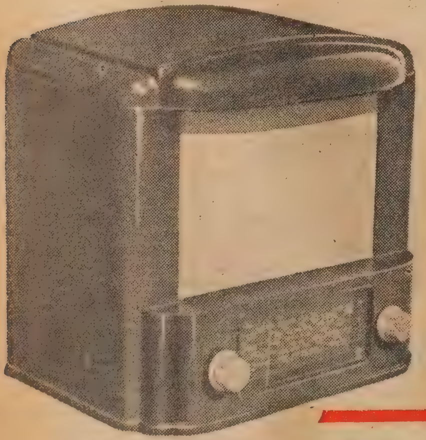

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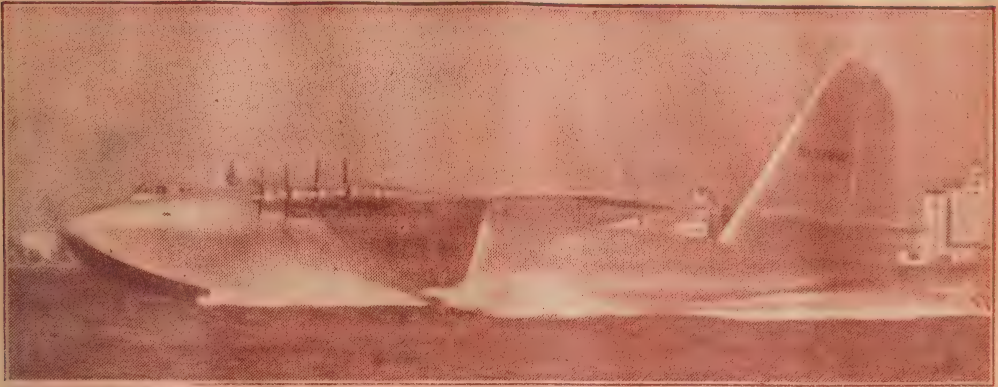
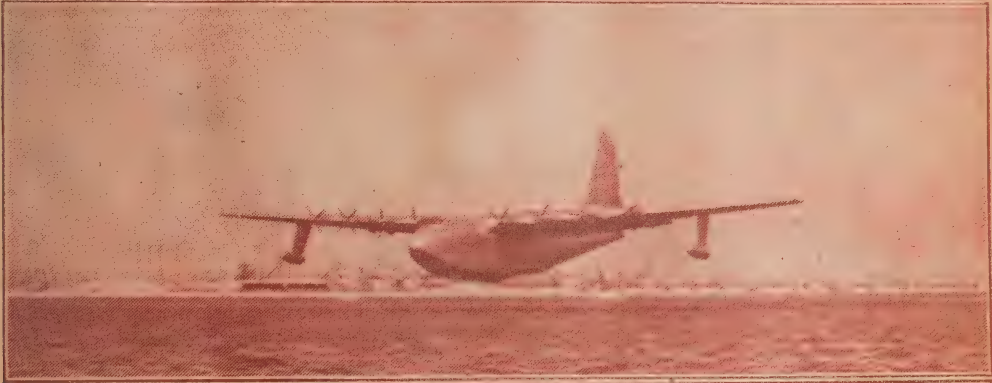
HOWARD HUGHES BOAT TAKES OFF





Howard Hughes, at the controls of the world's largest aerplane, intently watches the flight engineer's panels (at right, not visible) during engine tests preceding his surprise flight.

THE cloth "slippers" over his shoes are worn by all crew members to protect the interior of the huge craft.

The Hughes flying-boat, largest aeroplane in the world, will probably take the air again in March or April after intensive taxi testing on the water, according to Howard Hughes who lifted the sky giant off a choppy sea at Long Beach Harbor, California, in a brief surprise flight recently.

"I think the aeroplane is going to be fairly successful," Hughes commented soon after he amazed the thousands of persons gathered to watch the trial runs by taxi-ing the Hughes flying-boat aloft for a mile at a height of 70 feet.

"When we got up to 95 miles per hour I put the flaps to take-off position and it gave the plane so much buoyancy, and it felt so good, I just took it off," Hughes said.

"NO HANDS" BOMBER ATLANTIC FLIGHT

AUTOMATIC PILOT TAKES OVER

When a US bomber crossed the Atlantic without the aid of a human pilot or navigator recently, it relied on radar impulses from stations on the ground or on the sea, on the mechanical interpretation of those impulses in terms of direction, and on action by an automatic pilot to conform to those directional instructions. At the beginning and the end of the flight, the automatic pilot was also required to follow a particular, narrow path up to a given height and down from a given height to the ground.

By E. C. SHEPPERD

Separately, all these things had been done before. The combination of them into one long flight was an admirable piece of scientific design typical of the part which the United States played on several occasions during the Second World War. British research and American development were linked more closely in the field of radar than in any other. The United States Army Air Force has now produced another development which represents a logical outcome of work which was in progress during the war.

R.A.F. DEVELOPMENT

By 1943, the Royal Air Force had a piece of radar apparatus which could guide a piloted bomber to a target 600 miles away and tell the bombardier exactly when to drop his bombs, often on a target he could not see. That, perhaps, was not a surprising achievement, for Britain knew a good deal about radar before the war began.

The RAF was alive to the ordeal which might beset the country and had appealed to its scientists to make electronics serve the purpose of detection and interception.

REVERSED RADAR

To turn the radar system of detection inside out was a natural line. If radar echoes from enemy aircraft could be made to reveal them and to indicate their position, similar echoes from our own aircraft could be used to keep track of their courses so that each journey could be plotted from moment to moment on the map. When once we had got the detection system to work, it was relatively simple to go on to the other side of the picture and make the navigational radar plan work. Britain's lead and advantage in these applications of electronics arose out her peril and her need.

The newly-developed four-wheel main landing gear on a B-36 superbomber for Consolidated Vultee. The eight 56 inch wheels distribute the bomber's 278,000 pounds over a greater area than the two 110 inch wheels on the experimental XB-36. The four-wheel truck-type gears are lighter, safer in event of a blowout and have easier-to-service tyres.

At the beginning of the war, the secret was Britain's alone. It was a powerful factor in her victory in the Battle of Britain in 1940. After Pearl Harbor, it became a secret to be shared with the US and, like the gas turbine, it was shared without reservation, and, as lend-lease got into its stride, America acknowledged the gift by serving up radar in neat packets for special purposes. By that time, it had been given a variety of new applications in the Navy and Army as well as in the RAF.

GREAT POSSIBILITIES

Radar had advanced to the stage at which beacons were serving various purposes not only to help the pilots but also to help the forces on the ground (or sea) by touching off responders in our own aircraft which automatically sent signals identifying themselves as friendly.

The possibilities were almost endless and the scientists were under constant demand for new pieces of apparatus. They generally delivered what was wanted and, in a number of instances, the United States took over an ungainly bag of tricks and turned it into a neat, small, workmanlike box with the minimum number of knobs and dials and the least confusing scheme of wiring.

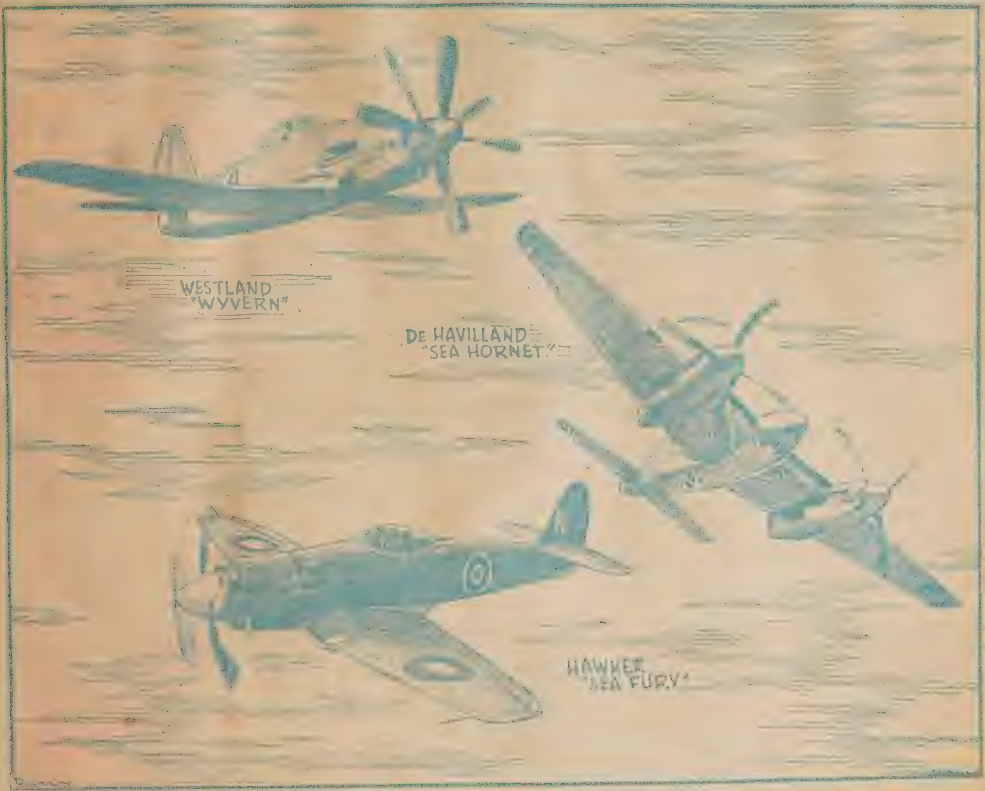
The automatic crossing of the Atlantic shows how nearly everything now has been put together into a single box of tricks. Precisely what form of directional aid was given by the radar stations on ships in the Atlantic is not announced. Some of us might make a good guess; but no Power in peace is likely to announce how its automatic bombers might be diverted and even turned back.

BEAM APPROACH

One thing about which there need be no secret is that part of the apparatus which controlled the take-off and landing—a beam directed along a glide path from one end of the runway that actuates two needles on a dial. So long as those needles are kept crossing each other at right angles, the bomber is following exactly the sloping path of the beam.

Britain, working on the guided missile, has not sought so far to equip a bomber for complete automatic guidance from bases on the surface of the earth. Possibly the primary British interest is in defence. If bombers can be guided by friendly radar they can also be misguided by enemy radar, unless (as in the American bomber recently) there are men aboard to see that things do not go wrong.

THREE BRITISH CARRIER PLANES



Despite the development of super-speed jet aircraft, there is still a place for more conventional propeller-driven types. This is a state of affairs likely to continue for some time to come.

SEVERE cuts in the Royal Navy have been made recently to meet Britain's financial and manpower crisis, but the need for maintaining an effective force has not been overlooked and new naval aircraft types have recently been announced. Three of these are sketched here.

The Westland Wyvern (upper left) is a new torpedo carrier and fighter.

Heavily armed, the Wyvern can show great pace, being powered by a 3500-horsepower Rolls-Royce Eagle motor—the most powerful piston-type aircraft engine in production.

AIRSCREWS

To absorb the motor's enormous power, the Wyvern mounts two four-blade contra-rotating airscrews, in each of which the blades are of the constant speed, full-feathering type.

The Wyvern is a low-wing monoplane with wide-spaced retractable landing wheels and a tail wheel which also retracts.

De Havilland's Sea Hornet (right) is the carrier-borne version of the Hornet, a descendant of the famous wartime Mosquito.

A single-seat fighter-bomber, the Sea Hornet has long range and good weight-carrying characteristics.

CEILING

It is said to have an operational ceiling of more than 35,000ft., and it can carry almost a ton of bombs or rockets. Four cannon are mounted in the fuselage, firing from below the nose of the machine.

The Sea Hornet has particularly "clean" lines. Landing wheels retract into the base of the engine nacelles, which are low slung in the centrally-placed wing.

The motors are Rolls-Royce Merlins, each developing 2070 horsepower, which drive four-blade full-feathering airscrews. Top speed of the plane is 460 miles an hour.

The Hawker Sea Fury (below), now in production for the Royal Navy, comes from an aircraft firm famous for its single-seat fighter designs throughout World War II.

In general appearance the Sea Fury has many points of resemblance to the famous Hurricane, but it is more powerful and has many characteristics of design that distinguish it readily. One of these is the wing, with its somewhat marked step back, less than a third of the way out along the leading edge.

The pilot's cockpit, covered by a "bubble" canopy, is placed well back in the fuselage, behind the long Bristol Centaurus XVIII motor. To absorb the motor's power, a five-blade airscrew is fitted. It is of the constant-speed, full-feathering type.

ROCKET ARM

The Sea Fury can be armed with four rocket projectiles of smashing power, or can carry two 500lb. bombs.

As the Royal Australian Navy intends to acquire British types of aircraft for its air arm, now in the preliminary stages of organisation, it is possible that some of these machines may see service in the Australian carriers. Two carriers are to be acquired, the first of which is expected to reach Australia towards the end of 1948.

PICTURE NEWS OF THE WORLD'S SKYWAYS

Swept Wing Fighter

THE United States Army Air Force's first swept wing fighter, the North American XP-86, is undergoing final preparation for its first take-off flight, with North American test pilot George Welch assigned to the task.

The new fighter is a modification of the US Navy's XFJ-1, although the introduction of the swept wing configuration created extensive design changes, followed by a lengthy wind tunnel test programme.

The fighter will be used to explore the tactical possibilities of swept wing design at supersonic speeds up to about 630 miles per hour, Mach. number .83 under standard conditions.

The swept wings, by moving the centre of lift rearwards, necessitated a lengthening of the fuselage nearly four feet, with accompanying relocation of the General Electric J-35 turbojet engine.

Unlike the Douglas D-558 and XP-86, air intake duct is continuous, and passes directly rearwards to the turbojet engine compressor inlet.

The nose air inlet features a large upper lip extension to furnish adequate air to the engine at high angles of attack (such as during landings).

The plane has 37-foot wing span and length.

Armament of six .50 calibre machine-guns is grouped in the nose, three guns on each side firing through louvres around the air intake.

Marked Skywards

THE "best-marked skyway in the world," from Los Angeles to Washington, is the aim of the civic and Government committee, it was announced recently.

The committee's purpose is to obtain a concentration of airmarkers along this skyway, so that it will be adequately marked for use by the average private flier.

Once this "sample" or "model" skyway is marked, the plan is to establish others, until the whole of America has been adequately marked for the safety of the flying public.

Additional aerial traffic along this route, both private and non-scheduled, is expected to result from completion of this "marked skyway."

Airline Ticket Machine

AN automatic ticket - vending machine, designed to provide the fastest ticketing procedure in commercial airline history, has been installed by American Airlines in its Boston ticket office.

Finished like a black typewriter, the machine resembles a large automatic toaster.

Near the top at one end is a slot, and below this is a coin slide similar to those on a juke box.

The machine contains a large pack of pre-printed tickets, in this case reading Boston-to-New York.

When a passenger has purchased his ticket, the ticket agent places a slug in the machine, pushes in the slide, and out from the slot pops a ticket.

Not a battery of field artillery, or shells leaving a cannon mouth. It's one half the power plant of the Martin XB-48, the complete line-up of which exerts more thrust than two 125-car freight trains. GE-Allison J-35 jet engines are used.

U.S.A. After Record

THIRTY-THREE international and national records have been established by the United States Army Air Force since VJ-Day, in a programme designed to capture all possible flying records for the USAAF.

The programme was initiated to put all standard AAF through a series of severe tests to determine the capabilities of first-line weapons in the AAF units

With the exception of the Lockheed P-80 Shooting Star, all aircraft types used in the record flights had been flown in actual combat by the AAF.

Other types of aircraft included the Boeing B-29 Superfortress, Douglas A-26 Invader, and the Sikorsky R-5 helicopter.

Most of the international records had been held by other nations, such as England, France, Italy, Russia, and Germany.

Of the US national records, all had been held by either experimental military aircraft or by specially designed civilian craft.

Of the records now held by the AAF, 25 existing international and three US national records were broken, four international records were established, and one record, the helicopter flight duration, was broken twice by AAF pilots.

Besides these officially-recognised records, the AAF also has established a number of unofficial records.

* * *

The first Hawker jet type, a Royal Navy fighter, has passed flight tests successfully at Bascombe Brown, England.

Known as the N.7/46, it is powered by a single Rolls Royce Nene II turbojet engine of 5000 pounds static thrust.

* * *

The Ride Backwards

HOW times have changed!

Remember the old days when no one wanted to ride backwards on a train?

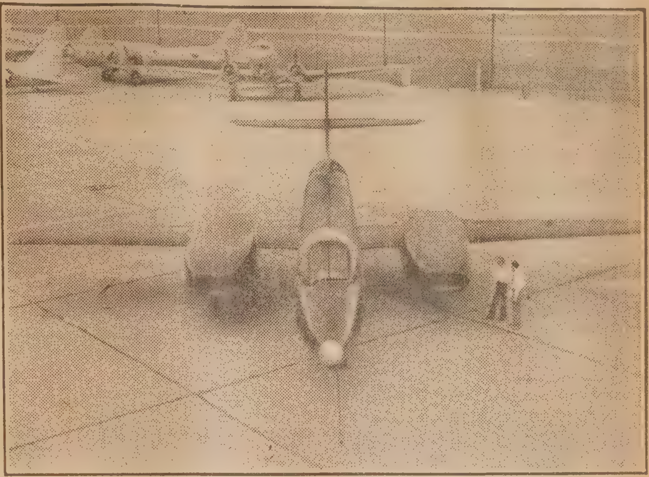
But it must be different in the air, for a recent survey shows that 96 per cent. of those questioned prefer seats in reversed positions, facing the rear of the aircraft.

Fast Bombers

NORTH American Aircraft Corporation's new multi-jet bomber, now undergoing tests at Muroc Field, California, is reported to be walking away from Lockheed P-80 fighters that accompany the bomber on all flights.

This would indicate the bomber can hit 600 miles per hour on the basis of the United States Army Air Force 560 miles per hour rating of the military model P-80 Shooting Star.

FIGHTER HAS FOUR JET ENGINES



The first fighter with four jet engines is this Curtiss XP-87 now undergoing tests for the US Forces. It has a crew of two, wingspan of 60ft., and overall length of 65ft. Specially-designed for all weather flying with the latest in de-icing.

More Thunderjets

REPUBLIC Aviation Corporation, of Farmingdale, Long Island, has received a new 15-million dollar US Army Air Force contract for additional P-84 Thunderjets, which will increase the number of the new jet fighters it has on order to more than 550 planes.

The contract for additional P-84's, fastest jet fighter, now in volume production for the US Army Air Force, was concluded following the successful completion of rigid performance tests of the new planes under simulated combat conditions.

The tests, which involved the firing of approximately 70,000 rounds of ammunition from the same set of guns, proved that the "Thunderjet's" guns fired about 50 per cent. faster than the guns used in World War II aircraft.

More than 10,000 rounds were fired from each of the P-84's six guns, with a minimum of 10,000 rounds per gun being fired from all six guns in salvo.

More than 75 per cent. of the rounds were fired at speeds near the critical mach number of the aeroplane, and a substantial proportion at speeds in excess of 600 miles per hour.

These followed earlier tests, which showed a stock production model of the Thunderjets, with full armament weight, were able to attain a speed of 620 mph in level flight.

Wing Tanks Fight Fires

SURPLUS jettisonable wing tanks, designed and used to carry extra fuel, are now being put to a new use.

Filled with water, they nip forest fires at their inception.

Special tail fins convert the tanks into bombs, and proximity fuses set off a shower at the right height above the fire.

Groups assigned by the United States Army Air Force are working with officials of the United States Forest Service in conducting test flights.

U.S. Buys British

EIGHT Rolls Royce Nene jet engines have been imported into the United States.

The United States Navy paid 26,118 dollars apiece for its experimental pair plus 2207 dollars duty.

The Grumman Aircraft Company paid 31,532 dollars plus duty for its six engines, scheduled for installation in the F9F Navy fighter.

British Freighter

THE much proposed feature of combination fuselage, freight hold and road trailer has been simply and ingeniously achieved in the new Miles M.68, which recently made its first flight.

To minimise ground handling and to speed shipments of air cargo, this British design ejects additional utility into the basic configuration of its predecessor—the one-ton-capacity fixed-fuselage Miles Aerovan.

Essentially, the M.68 is an airframe serving as a chassis for a detachable container, 10ft. long by 4½ft. square, accommodating a 1600lb. payload for a still air range of 400 miles at a cruising speed of 130 miles per hour.

The unit is located between the cabin and special aft fuselage fairing.

After fitting with removable wheels for roadability, the freight container is disconnected from the plane, and with a tow bar is readied for use as a trailer for transportation to its ultimate destination.

For quick turnabout facility, the craft may immediately be fitted with another loaded container, or may fly without cargo compartment by attaching the rear fairing directly behind the cabin.

New Corsair

THE F4U-5, a faster, more powerful version of the famous Corsair fighter-bomber, was announced in connection with Chance Vought Aircraft Corporation's 30th anniversary.

The new Corsair retains the external appearance of its famed predecessor, the F4U-4, but has been completely redesigned within the fuselage.

It is already in production.

The F4U-5 is equipped with Pratt and Whitney Aircraft's new R-2800-E Double Wasp engine and Hamilton Stardard's improved type four-bladed Hydromatic propeller.

Various refinements are built into the new fighter to increase the pilot's comfort and efficiency.

The cockpit canopy, control surface, trim tabs, and auxiliary hydraulic pumps, are all power-actuated.

An adjustable seat has folding arm rests, and brake pedals, which can be swung down to serve as leg rests on long flights.

XB-46 Details

THE jet-powered XB-46, America's newest four-engine bomber, successfully completed Phase II flight tests several days ahead of schedule.

The Phase II flight testing programme, conducted by the US Army Air Force at Muroc, consisted of 20 hours of flying.

In logging the 20 hours, Air Force test pilots made nine flights in less than a month.

All of their flights were made at the jet bomber's design gross weight of 91,000 pounds, with sandbags and lead weights for ballast.

The experimental bomber either met or exceeded all design requirements, and both company and Air Force test pilots have been impressed with the plane's high speed, manoeuvrability and ease of handling.

Several features of the aerodynamically clean XB-46 are new developments.

Chief among these are the two-engine-per-nacelle arrangement; the three-man crew; the all-pneumatic system for actuating landing gear, bomb doors and brakes and the fighter-like jettisonable canopy.

A PANTOGRAPH DRAWING REDUCER

To make a detailed design or pattern drawing to a smaller scale is frequently desirable, but can be an extremely tedious job if attempted without mechanical means of reducing. Often a design is only pleasing to the eye when made to a certain size, and the patience that can be saved by the preliminary outlining of a pattern to a reduced scale by a pantograph is enormous. Any portions requiring modifying to improve appearances at the reduced size can easily be undertaken.

THE pantograph reducer shown in in the accompanying drawings is in its basic form, and will give accurate reductions. Those who have a metal turning lathe at their disposal will at once notice a number of improvements that can be effected, particularly as regards improved means of adjustment for the pencil point and bearing. The reducer consists of five links (Fig. 1), these shown as details Nos. 1, 3, 6, 9, and 11, all of which are pin-pointed together, one corner being attached to a steadying weight (detail No. 2). The centre member of the links (detail No. 11) carried the pencil point, the tracing needle being diagonally opposite the weight. With dimensions as drawn, the pencil will copy a design traced by the needle to the following scales, 2/3, 5/8, 3/5, ½, 2/5, 3/8, 1/3 and ¼ full size, these being found by experience to be the most used scales.

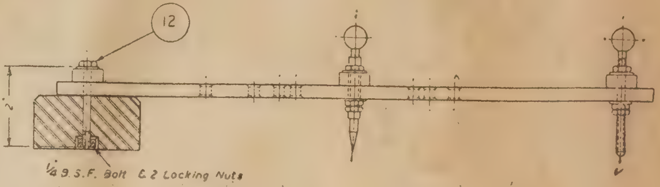


Fig. 2.—Part sectional end elevation showing detail of steadying weight and arm 1.

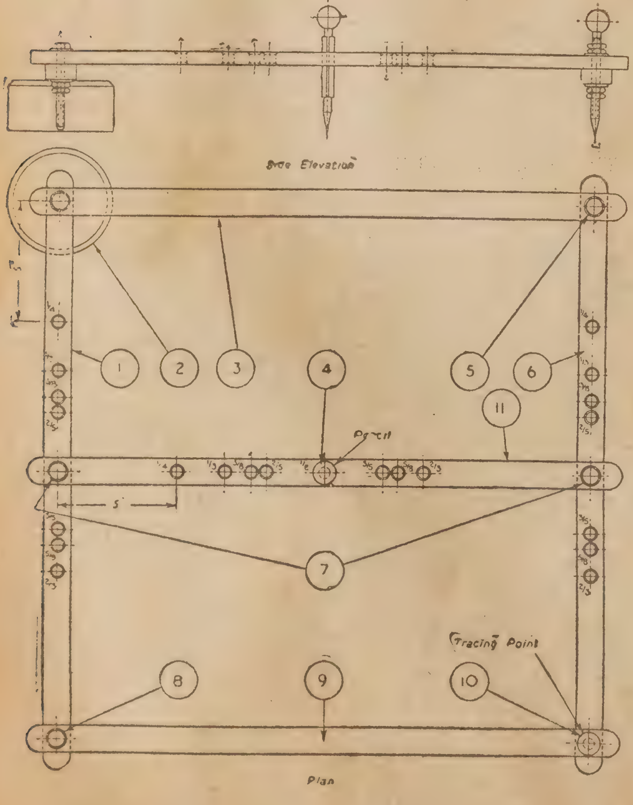


Fig. 1.—Side elevation and plan of the finished pantograph showing numbered details.

CONSTRUCTIONAL DETAILS

For the five link members a well-seasoned hardwood is best, although ordinary deal will give good service. Very careful attention to the size and smooth finish of the holes is essential; if there is any slackness or tightness true reproductions are impossible. As all the hole centres are relevant to each other they must have identical positions in each link, for example, where the four members (details Nos. 1, 3, 6 and 9, Fig. 3) are connected to each other at the corners the pitch of the holes is 20in., and similarly for the member carrying the pencil.

To ensure accuracy, drill one link, say detail No. 3, with the two holes, the other four only one hole, then place them in turn under detail No. 3, with a bolt through the holes at one end, and transfer the second hole. With reasonable attention a hundred per cent. accurate job is accomplished. The next stage is to drill the holes for the pencil holder and the series of holes for the position of detail No. 11 through the various reductions. This can be done in a similar manner as the first set of holes by marking out and drilling detail No. 11, then placing under it in turn detail Nos. 1 and 6. With a bolt in the end holes, spot through the positioning centres, but do not drill right through, for the outside links may require slightly smaller holes than the ones for the pencil holder.

The steadying weight shown can be of any heavy substance drilled and counter-bored to suit bolts and lock nuts (Fig. 2).

TRACING POINT

The tracing point is a ¼in. bolt reduced to a point at one end, the head being cut off and inserted into a small lifting handle, which can be pinned or glued to keep it in place. The point can be adjusted for height on assembly.

Detail Nos. 5 and 8 are two steadying pins, which ensure the framework always being horizontal whilst in use; they are merely ¼in. bolts with the ends rounded and well smoothed to facilitate the links sliding easily.

PENCIL HOLDER

The pencil holder, detail No. 4 (Fig. 4), consists of a piece of sheet brass or steel bent around a rod, the inside of the tube to be a snug fit for the pencil. The lifting knob is a piece of wood domed as shown, the shank having a slight taper to fit tightly in the tube. When assembled, the taper shank of the knob expands the tube and tightens the holder in the link member. Make a few trial holes in a scrap piece of wood to find the most suitable size before drilling detail No. 11.

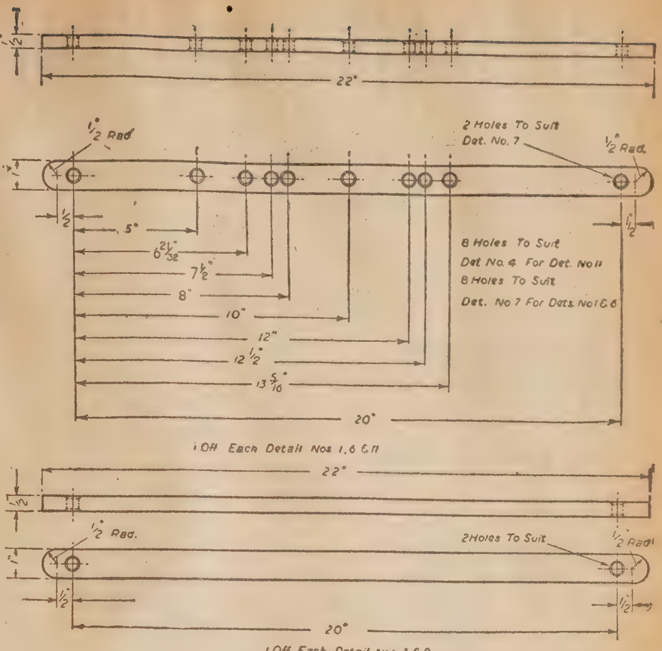
On assembly insert washers between the heads and nuts of the bolts to ensure a smooth action. A smear of tallow or similar substance acts as a lubricant and prevents corrosion between bolts and wood.

USING THE PANTOGRAPH

As depicted, the pantograph is set to reduce a design to half that of the original. To obtain the other scales, remove the bolts (detail No. 7), lift off the link carrying the pencil-point and transfer it to the corresponding pair of holes in detail Nos. 1 and 6, the scale of reduction being shown in the plan view. Next remove the pencil and holder and replace it in the position required for the new reduction scale, which is also indicated in the plan. As an example, assume that a scale reduction of 2/3rds. is required. After removing detail No. 7, the member carrying the pencil is brought forward three holes, corresponding to the figure 2/3 marked on the left-hand link, and the bolts replaced. Next, the pencil holder is withdrawn and moved three holes to the right, which again is marked 2/3, and replaced. As a check on whether the pencil is in the correct position, a straight edge should show detail Nos. 12, 4 and 10 lying in the same place for all positions of the pantograph.

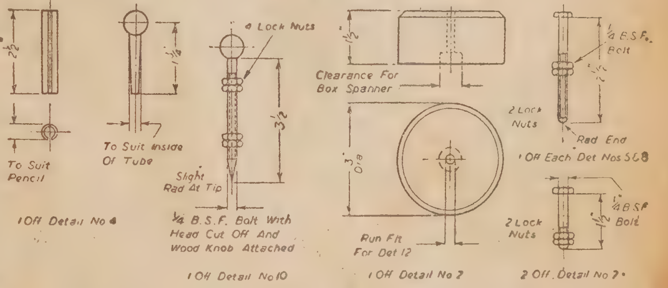
Pin the drawing to be copied on to a flat surface, then affix the blank piece of paper for copying; this should be placed parallel to the drawing, the actual position of it being found by the limits of the design to be copied.

A new type of map paper can be soaked in water without being damaged.



22"
1/2 Rad
2 Holes To Suit Det. No. 7
1/2 Rad.
1/2
5"
6 21/32"
7 1/2"
8"
10"
12"
12 1/2"
13 5/16"
20"
8 Holes To Suit Det No. 4 For Det. No 11
8 Holes To Suit Det. No 7 For Dets. No 1 & 6
1 Off Each Detail Nos 1, 6 & 11
22"
1/2 Rad.
2 Holes To Suit
1/2 Rad
1/2
20"
1 Off Each Detail Nos. 3 & 9

Fig. 3.—Details of pantograph arms.



To Suit Pencil
1 Off Detail No 4
To Suit Inside Of Tube
Slight Rad At Tip
4 Lock Nuts
¼ B.S.F. Bolt With Head Cut Off And Wood Knob Attached
1 Off Detail No 10
Clearance For Box Spanner
Run Fit For Det 12
1 Off Detail No 7
¼ B.S.F. Bolt
2 Lock Nuts
Rad End
1 Off Each Det Nos 5 & 8
¼ B.S.F. Bolt
2 Lock Nuts
2 Off Detail No 7

Various component parts including the pencil holder and tracing point.

LIQUID GLUES AND ADHESIVES

By HANDYMAN

BY the word adhesive I refer to all such "sticky stuffs" as employed for uniting paper, cardboard, leather and smaller wooden objects to each other, and, naturally the liquid and other cold glues which ordinarily would have been considered in the last article may be classified with the adhesives; the gums, the liquid fish-glues and starch pastes.

There is nothing much to say about the making of these glues, except that they are derived from bones and offal of fishes, and that the edible isinglass is a highly refined product made from selected parts of the fish, bearing much the same place in relation to common fish-glue that gelatine does to animal-glue. Isinglass, however, is sometimes used for the finer cements, and is therefore not an adhesive in the ordinary sense of the word, except where it is used in the making of "court plaster," an adhesive silk for cut fingers.

Liquid fish-glues are supplied in collapsible tubes in all sizes and qualities and under various trade names. Seccotine is the forerunner of this most convenient form of adhesive, and a small tube is obtainable for a few pence.

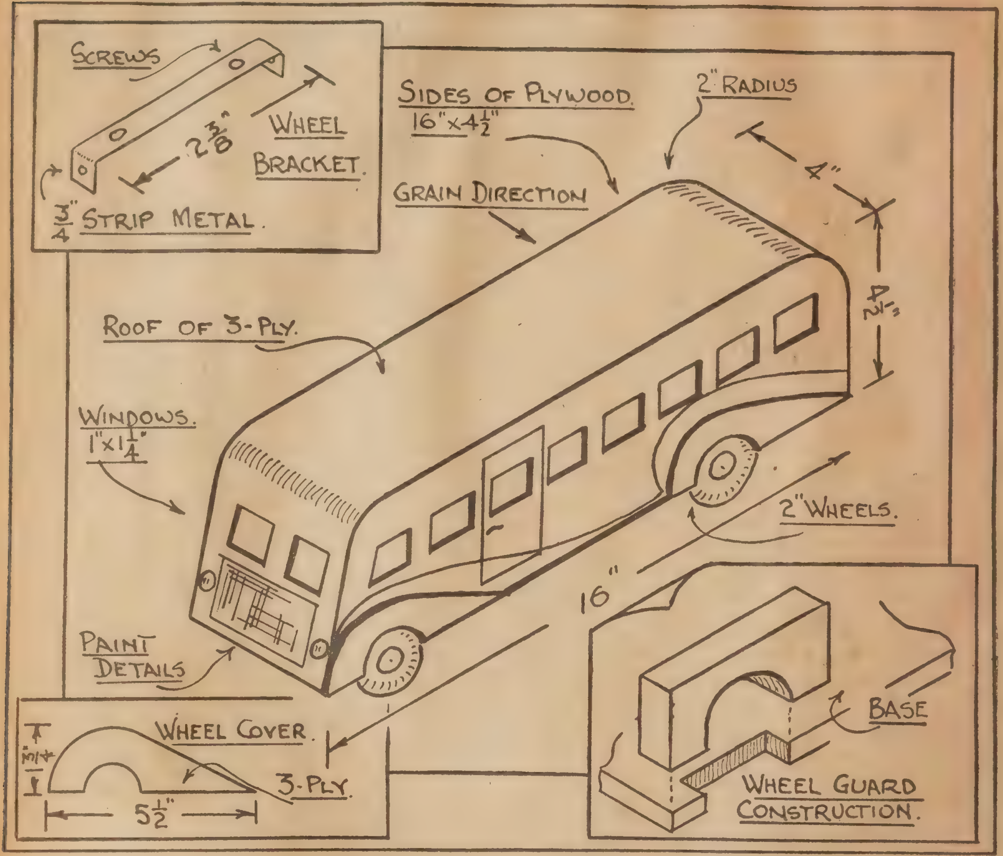
The liquid glue is known under the name of "Croid," and is a quality of cold glue which, besides having a general utility, is to be recommended for small joinery and other woodwork where a small quantity of the agglutinant is required at a time. It is excellent for model-making purposes.

USING LIQUID GLUES

As in the case of hot glues (carpenter's hide glues) the minimum amount of cold glue should be used

(Continued on Page 81)

A LIFE-LIKE BUS FOR PLAYTIME



Continuing the series of wheel toys, the Playtime Bus forms a useful addition for leisure activities. Generally speaking, the construction is of wood. The pieces needed are small and almost all of them can be cut from scrap. Several short lengths of three-ply are also needed.

At first two lengths of three-ply 16"x4½" are required for the sides. Fasten the two pieces together with small panel pins, plane one long edge straight, and then mark out the shape. Make sure that the radius at the corners is not too small, otherwise the ply roof will not bend to shape. Two parallel lines are drawn lengthwise along the wooden sides to determine the portions to be cut out for the windows when required. The approximate size of 1"x1¼" for each is suggested, but this may have to be varied a little, say at each end, to allow the windows to be spaced evenly. If desired, a door can be cut near the front end of one side, although in the model illustrated this detail was painted on. Mark out the grooves for the wheels by drawing semicircles of 2½" diameter where needed.

Next, with a coping saw, cut the sides to shape. First of all remove the waste from the outside edges and plane the sawn parts smooth. Keep the edges perfectly square. Before cutting the windows, a small hole will have to be drilled through each corner to allow the coping saw blade to enter. Cut the windows to shape and sandpaper the edges smooth.

The chassis of the Bus is a piece of wood 16"x3⅜"x½". Out of the two long edges both at front and rear, two small pieces 2½" long are cut to take the wheels. Those in the front (shown in the details) should be about ½" from the front of the chassis and the two rear ones 2¼" from the end. Before cutting out the pieces, strengthen the projecting sides with a few 1" panel pins.

The two sides can now be fixed in place on the chassis. To cover the wheels inside the Bus some wheel guards are necessary. Four of these are required to be made of ¾" wood. The little blocks are shaped as shown in the sketch, the cut out piece being somewhat larger than the diameter of the wheel. The inside guards can be nailed in place to both the bottom and the sides. Four small pieces of ply will act as inside covers and these can be fastened in place with a few panel pins.

The roof and ends consist of a single piece of three ply 4" wide. The easiest way to get the correct length is to stretch a piece of string around the sides and transfer this measurement to the ply. Allow about ½" extra on each end to give strength while bending. This waste is easily sawn off afterwards. To enable the ply to bend more evenly, make sure that your piece has the outside grain running across the width of the ply.

Now glue the edges and with 1" panel pins fasten one end of the ply in place on the chassis. Working from here, gradually bend and nail the roof in place until the whole is nicely bent and fastened securely. With a little coaxing the ply will take the desired curve. Punch down all nails and when the glue has set cut off any excess pieces of wood. With a file and sandpaper, round all sharp edges to give the job a pleasing appearance. From one end measure 3¼" up the curve and mark out the position for the windscreen. The size of this is in relation to the window openings. A similar opening at the other end will serve as a rear light. These parts are rather difficult to saw out but, with care, can be done by using a broken coping saw blade forced into a piece of ⅜' dowel which will serve as a handle. Use this little instrument as a miniature saw.

Four outside wheel covers are needed. These are made of ply and to the dimensions shown in the sketch. Make the rounded cut out piece smaller than the diameter of the wheels as this gives a more pleasing appearance. Nail these in place. Strips of ply are also nailed beneath the chassis from the ends of each wheel cover to form a dummy splash ledge.

On the Bus shown four 2" diameter tin wheels were used, being fastened in place on wire axles in metal brackets. These brackets are made from ¾" strips of sheet metal bent to shape as shown. After this, four holes must be drilled in each, two to take small screws to hold the bracket in place and two through which the axle will pass.

The axles are made from a piece of stout wire. Solder one wheel to this, pass the other end through the necessary holes in the bracket, and then solder the other wheel in place after cutting off the surplus wire. After making two wheel sets screw them in place under the Bus and test for level. This can be adjusted easily by loosening off one screw and raising the bracket with a small chip of wood after which the screw is tightened again.

Careful painting will greatly increase the effect of the toy. Three-tone coloring is suggested, two of blue and one of cream. First of all give the whole Bus several coats of cream enamel. Then along the bottom half of the Bus and about ⅛" below the window line, go over this with light blue. The streamline shape is painted on last in dark blue. Divide the colors by a thin black line. Details of headlamps, radiator grille, &c., can be painted on in fine black lines also.

LIQUID GLUES AND ADHESIVES

(Continued from Page 79)

in making a joint, and perfect contact between the two parts is essential to the strength of the job. Rubbing the objects together to exclude the superfluous adhesive is therefore recommended. If there is bad contact between the united parts, the area of the exposed glue is considerable and dampness in the atmosphere can more easily penetrate and weaken the joint.

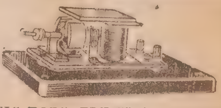
This may not be quite so serious a matter with glues of the nature of "Croid" or "Seccotine" as with carpenter's glue, which is most susceptible to atmospheric changes, but there is bound to be some detrimental action on the adhesive if the joint is not a close one. Grease is an enemy of all adhesives, and, therefore, surfaces which are to be attached to each other should be free even from the natural oils which are present on the fingers.

In winter, cold glues are more viscous—even hard—and if, when the tube is squeezed, the adhesive comes out in a sort of crystallised form, it should not be used without slightly heating. In a cold room, or on a winter's day, it is best to place the tube of adhesive in a cup of hot water for a few minutes before using. Seccotine tubes are usually supplied with a metal peg with a looped handle end, which is replaced in the nozzle after use.

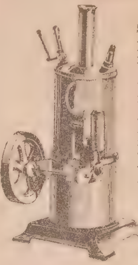
This is the simplest and best device to prevent loss of glue and to ensure a ready flow when the glue is required to be used again. Where this sort of stopper is not provided, as in the cheaper qualities and sizes, a small nail or a stout household pin will serve the same purpose.

PASTES

These are usually made from one of the flours or starch and there are innumerable recipes in common use. Dextrine is a manufactured substance which is almost identical with starch and is sometimes termed "British Gum." The granules in starch and flours are insoluble in cold water, but when heated with water of a temperature of about 75 degrees Fahr. these granules split up and adhesive "glutens" and "albumen" are formed. Both these substances possess powerful adhesive qualities, and the paste is of a double tenacity when they are both liberated. Decomposition of flour and starch pastes is due to the fermentation of the cereal constituents, and therefore preservatives are necessary. Pastes made from farina (potato starch) are not so strong as wheat or rye flour pastes, and sometimes the addition of one of the glues is resorted to. With the hide glues such a paste is more liable to putrefaction.



THE "VIC-TOR" ELECTRIC MOTOR. Runs on 4 or 6 volt battery. For your model driving or boats. Price 13/3 each. Reg. Post 1/3 N.S.W. Suitable battery 3/3 extra.



STEAM DRIVEN Donkey engine, 9 inches high. Fitted with safety valve, runs for 20 minutes, brass flywheel. Drives builder set models. Price 26/9 each. Post 1/3 N.S.W.

Write to us for the 80-page book, "PLAYTHINGS," free.

BE THE ENVY OF ALL THE BOYS WITH THIS SUPERIOR TOP.

PLASTIC PEG TOP. A wonderful spinner, beautifully made. Price 1/3. Complete with cord. Reg. Post 6½d.

WALTHER & STEVENSON Pty., Ltd.,
391-5 George Street, Sydney.

OSCILLATOR KITS

COMPLETE AC OSCILLATOR KIT OF PARTS. Ready for assembling, including 3 Valves and Tax £10/12/3

(This oscillator assembled is priced at £17/10/-)

SIGNAL TRACER, assembled ready for use, including Tax __ .. .. __ £15/19/-

METAL BOX and CHASSIS, with beautifully engraved panel for oscillator. Including Tax £1/19/8

(Unobtainable elsewhere).

COMPLETE BATTERY OSCILLATOR KIT OF PARTS, complete for assembling, including Tax .. __ __ __ £8/5/-

We can supply Universtiy — Palec and Radameta Testing Equipment and all Radio Accessories.

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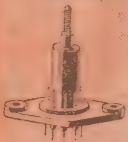
COIL FORMERS BASES COMPONENTS PADDERS

★ *For Mantle,*
★ *Console &*
★ *Personal Radios.*

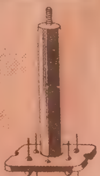
MIDGET COIL FORMER



Ideal for use for broadcast or short wave coils—similar to those used on our new midget magnasonic coils—has 5/32 nuts moulded into top to take standard iron cores.

Size 1" x 1" can I 32.

4 AND 6 PIN COIL FORMER



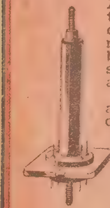
This former is suitable for the construction of all broadcast coils and may be grooved for use with dual wave coils.

Available with or without iron cores to suit 1⅜ square can x 2 3-8" deep.

4 Pin Type No. I 30

6 Pin Type No. I 31

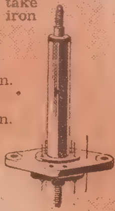
INTERMEDIATE TRANSFORMER FORMERS



An outstanding feature of this component is that condensers of 70 m.m.f. or 100 m.m.f. are moulded into the base, simplifying the construction of the finished article.

The four protruding leads are spot welded to the condenser and cannot open circuit to the condenser.

This former also has two 5/32 Whitworth nuts moulded in the base and top to take standard iron cores.



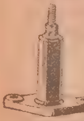
Available in three types.

1 3-8" x 2½" for square can.
Type No. I.F. 27

1 3-8" x 2½" for round can.
Type No. I.F. 28

1" x 2" for round can.
Type No. I.F. 29

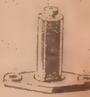
STAND OFF INSULATORS



Mounting screw type—fitted with 5/32" Brass nut & bolt with solder lug attached. Mounting hole centre 1" x ⅛", moulded from Black Polystyrene.

1" Type No. A.F. 18
1½" Type No. A.F. 19
2" Type No. A.F. 20

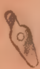
STAND OFF INSULATORS



Pin Jack Type — fitted with Pin Jack to fit standard Banana plugs Mounting hole centres 1" x ⅛", moulded from Black Polystyrene.

1" Type No. A.F. 15
1½" Type No. A.F. 16
2" Type No A.F. 17

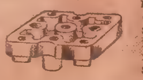
SOLDER LUGS



Pressed from tin steel, available in sizes as under:

SL 3 Single ended
SL 4 Pear shaped
SL 5 Double ended

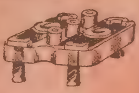
I.F. BASES



As used in Air Trimmer Type I.F.'s. moulded with two 6 B.A. inserts capable of holding sufficient plates for 350 m.m.f. per side.

Type No. M. O. 15

I.F. BASE COMPLETE

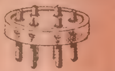


Moulded from Polystyrene with nickel silver top plates.

2 plates per side. Type No. A2.

3 plates per side Type No. A3.

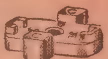
6 PIN COIL PLUGS



Fitted with 6 standard nickel plated base pins, ideal for amateur use.

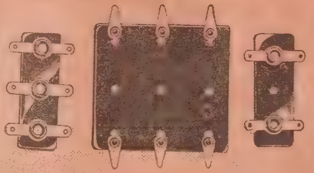
1¼" Type No. I 27
1½" Type No. I 28

PADDER BASE



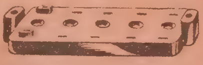
Clear Polystyrene with 6 B.A. insert for fine adjustment of trimmer plates.

Type No. M.O. 14.



RESISTOR STRIPS

Black Panel mounting strips 2in. wide by 12½in. long with 25 lugs per side.
MS 7, retail, 3/6.
MS 8, retail, 1½d. per in. (½in. wide any length).
MS 1, retail, 3d. ea. (Bakelite Anchor Strip).

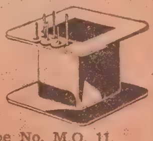


FIVE IN ONE TRIMMER BASE

Moulded from Polystyrene, this base has the necessary inserts for four coil trimmers and one padder, complete in one unit.

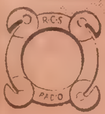
Type No. M.O. 12.

SQUARE COIL BOBBINS



These are made in two sizes with 7-8 x 7-8 and ¾ x ¾ square hole, and are for use in Speaker Transformers, Audio Transformers and Filter Chokes, etc. 7-8 x 7-8, Type No. M.O. 10. ¾ x ¾, Type No. M.O. 11.

TRANSPOSITION BLOCKS

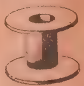


Available in sets of eight.

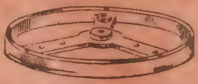
size 1 3-8" x 1 3-8".

Type No. A.F. 12

RELAY BOBBINS

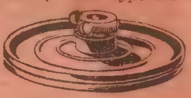


Circular bobbin 1in. dia. x ⅜in. long by 3-8in. centre moulded from Black Polystyrene. Type No. M.O. 13.



LOOP AERIAL COIL FORMER

This former is moulded in Clear Polystyrene, and is used for support of Loop Aerial Coils and has the necessary Aerial Trimmer fitted to one of the spokes and is engraved with terminal markings. Size 3¼" dia. Type No. M.O. 9.

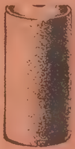


DIAL DRIVE DRUM

This drum is moulded from Black Polystyrene with heavy brass bush drilled 3-8", fitted with 2—5/32" grub screws (& spring) drilled for use.

3" dia. Type No. M.O. 8.

IRON CAN

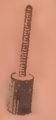


This core shield is moulded from Magnetite Iron dust and sprayed with copper as electro-static shield and is made in following sizes.

2" x 1" dia.
Type No. M.O. 6.
1" x 1" dia.
Type No. M.O. 7.

These cans can be fitted to short wave coils without loss.

IRON CORES

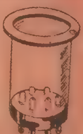


Magnetite (F.E. 304) 5/32" Whit brass screws made in five sizes.

3/8" Type No. M.O. 1
7/16" Type No. M.O. 2
½" Type No. M.O. 3
9/16" Type No. M.O. 4
¾" Type No. M.O. 5

The above have particularly high Q at high frequency.

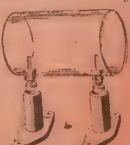
6 PIN PLUG IN COIL FORMERS



Manufactured from Polystyrene powder (enhancing the electrical qualities.) Engraved for frequency and type and can be grooved for space winding. Nickel plated valve pins. Made in two sizes.

1¼" Type No. I 24
1½" Type No. I 25

CLEAR POLSTYRENE TUBING



Made in following sizes.

2⅛" long, 1½" dia.
Type No. M.O 16.

2⅛" long 1¼" dia.
Type No. M.O. 17

R. C. S. RADIO PTY. LTD.

174 CANTERBURY ROAD, CANTERBURY, N.S.W. AUSTRALIA

MORE ABOUT RECORDING TECHNIQUE

(Continued from Page 43)

script calls for them to give play to their histrionic talents. Fortunately, even if they do momentarily "beat" the attack time delay, their frequency is so high that they do not usually cause overcutting.

Actually, the most aggressive sounds in recording lie in the bass register, coupled with a heavy transient. A tympani drum is an example of this. Sudden high-pitched noises, like revolver shots, handclapping, shattering glass and so forth, are not nearly so dangerous, although they cause the engineer to fear for the well-being of his level-indicator, as the needle tries to go round the meter about three times!

But to return for a moment to the volume compressor circuit. Note that all the elements are run positive to ground on a heavy bleeder across the B-plus supply. This stabilises the electrode potentials under dynamic conditions, and the relative polarities are arranged so that, for instance, the grids are merely less positive than the cathodes. This is another way of saying that they are negative to the cathodes.

You might wonder why the entire master-diode circuit is operating at a positive potential. It is, in fact, about 27 volts above ground. The reason is this. It is found that another 27 volts of bias on the AVC grids is needed to bias the compressor stage to cutoff. Since there is no point in driving a stage beyond cutoff in this application, the slave-diode plate is merely grounded. Thus, when the AVC voltage exceeds 27 volts, the slave diode conducts and shunts out the AVC line. This is done so that there will not be any unpleasant gaps of silence arising from loud peaks cutting-off the compressor stage. This characteristic is one of the most objectionable which a compressor can have, and in this particular circuit we have largely defeated it.

The plate circuit of the compressor stage is transformer coupled—although it could be choke-coupled—and the reason for this is that the plate circuit must have good regulation. The low-DC resistance of the transformer or choke windings gives us excellent regulation.

BUILDING A S-WAVE CONVERTER

(Continued from Page 29)

To put the converter into operation connect it up as described and tune the main receiver dial to a clear spot near the low frequency end of the band. Tune in a steady shortwave signal on the converter and adjust the trimmer on the converter output coil for maximum signal strength. If the trimmer has to be screwed hard in, connect a 25 mfd. condenser in parallel with it and try again. With an iron-cored coil a peak can be obtained alternatively by adjusting the slug.

Leaving the receiver tuning fixed, tune the converter to a weak station at the high frequency end of the shortwave band and peak of the aerial trimmer for maximum response. Then tune to the low frequency end of the band and adjust the aerial slug, if provided, for maximum output. Re-check the aerial trimmer for maximum output.

If the coverage has to be modified to suit the dial requirements, unscrewing both trimmers by a small amount will extend it in the high frequency direction. Screwing them in will have the reverse effect. Screwing both cores in will shift the coverage towards the low frequency end, while unscrewing them will extend it in the other direction.

There is not much else to be said. The converter is such a simple device that there is very little room for error, while the adjustment of it is straightforward.

MAKING A "B" ELIMINATOR

(Continued from Page 59)

for those not having access to a high resistance voltmeter. The performance of the receiver on batteries, as compared to that on the power unit, would be a further check on the voltage.

As far as the actual construction of the unit is concerned, a chassis of some sort is a necessity. The exact size and shape is of no great importance, as long as it is large enough to fit all the components without undue crowding.

The bolts holding the transformer laminations together should be properly tightened to prevent them vibrating, and the other small components mounted in such a way that they cannot flop about and cause a short-circuit.

The exact specifications of the choke are of no great importance, as long as it can carry about 40 ma. without undue stress and has a reasonable inductance. If nothing more pretentious is available, the primary winding of an old speaker transformer can be pressed into service. The secondary leads are just left floating or cut off.

A little ingenuity and a couple of hours' work are rewarded by a unit which will allow you to listen to your battery radio for as long as you please, without having to worry about flat B-batteries.

TUNING COILS

(Continued from Page 57)

The same warning applies to the super-regenerative type of detectors, where the circuit goes into oscillation at a repetition rate above the audio frequency range of the human ear. This repetition rate is called the "quench" frequency.

The use of an RF stage ahead of the detector isolates the detector from the aerial circuit and eliminates the interference problem. The stage also contributes much to the general performance of the set.

SELECTIVITY

The term selectivity refers to the ability of a set to separate stations transmitting on frequencies which are very close together.

With one valve sets or sets with a detector and audio amplifying stage there is only one tuned circuit to select the incoming signal voltages. The selectivity of the one-tuned circuit depends upon the efficiency of the coil and condenser, the ratio of the capacitance to inductance, and the operation of the reaction circuit.

The efficiency of the coil-condenser combination depends upon the "Q" of the coil, as mentioned in last month's article, the insulation and the dielectric losses of the condenser.

However, even allowing for these factors, the selectivity provided by a one-tuned circuit is insufficient for good communication work or satisfactory reception on some of the crowded international short-wave broadcast bands. This fact, coupled with the need for versatility and ease of control, has indicated the use of superheterodyne circuits in all but the simplest receivers.

3-DIMENSIONAL PHOTOGRAPHY—

THREE - DIMENSIONAL photography soon will be released from its secret classification. Douglas Winnek, developer of the process, believes that magazine covers, advertisements, book jackets and bill-boards will be using the process in 12 to 18 months. Pictures give observer the illusion of looking around foreground objects, which appear to move in relation to those in background.

Applicable to still pictures, movies, television, and graphic arts, only the process for still pictures has been completed. During manufacture of films, the film is embossed on the base side with thousands of tiny curved ridges, too small to be seen. Each ridge forms a semi-cylindrical lens knows as lenticulation. Ridges break up image into a series of stereoscopic pictures. Ridges act as selecting screen, allowing each eye to see only its respective part of the stereoscopic picture.

SHORT WAVE NOTES BY RAY SIMPSON

NEW ZEALAND TEST PROGRAMMES

ENTERTAINMENT PLEASES

Possibly the most interesting stations heard during the past month have been the New Zealand transmitters ZL2 on 9540kc, ZL3 on 11780kc and ZL4 on 15280kc. These stations carried out a week of test programmes and provided a feast of entertainment which made one reluctant to leave them in order to log other stations.

THE quality of the transmissions was the finest we have ever heard and superior to the local broadcast band stations despite the fact that they can prove they have perfect quality.

We are indebted to Mr. Harold Webley, of Lower Hutt, NZ, and our old friend Mr. Hilton Cox, of Cobden, NZ, for sending us early news of these test transmissions and also thank the many Australian listeners who were also kind enough to write us concerning them.

According to the closing announcement on the last night of the tests, it is not yet known when the stations will be on a regular schedule. We certainly are looking forward to the time when they are on every night if they can maintain the same strength and quality, though, of course, being what we are, in time we will start to grumble at not being able to hear other stations on the same channel owing to the strength of the New Zealand stations.

HIGH FREQUENCY ACTIVITY

Although it is not exactly in the scope of these notes, we think listeners will be interested to know of the interesting amateur contacts which can now be heard on the 50 to 54mc amateur bands. Almost every night from around 7.0 o'clock there are some of these boys on the air and there is something very fascinating about this band as compared to the bedlam which exists on 40 metres and to a lesser extent on 20.

The writer has erected a new 40 foot mast with a rotatable 6 metre beam on top and a 91mc FM folded dipole on top of that again.

D.X. CONTEST

Readers are reminded that all verifications for the contest must be received by 31st January, 1948, and we hope that in an early issue we will be able to give the results of both sections of our competition.

THESE STATIONS HAVE VERIFIED

VERIFICATIONS have been received by the following readers for reports sent to the undermentioned stations.

Mr. Rex Gillett. Johannesburg 4895kc, 6007kc, ZNB, LRR, LRX1, OZH2, XEBR, Rangoon 6040kc, Vienna 11,785kc, HER6 15,310kc, HER5 11.870kc, HER3 6165kc, WLKS 6065kc, ZBW 9515kc, Radio Eireann 9595kc, Radio Tabriz (1st report from Australia), VP4RD, Ponta Delgado, HP5H.

Mr. Max Krumbeck. Radio Nacional de Espana, KZPI, ZBW3, OTC2, HER4, LRM, CKNC, CHOL, Singapore 15,300kc, Paris 11,845kc.

Mr. A. Cushen. HI2T 7275kc, 11,900kc, H5CA, LRM, Radio Romania Libera, OLR2A, OLR3A, OLR4A, HC4EB, ZPA3, Rangoon.

Miss D. Sanderson. HS8PD, Radio Malaya 6770kc, 4820kc, 9690kc, 11,735kc.

Mr. L. D. Corstorphine. CFRB, KWID, KWIX KNBA, KNBI, VLC7, VLB10, VLG10, VLR2, VLW, VLQ2-3, VLH4, ZJV.

Mr. R. O. Block. XGOY 7153kc, 11,913kc, 15,170kc, Tirana, Dakar 11,713kc, FZI 9440kc, 9980kc, 11.970kc, 17,845kc, XDY 9917kc, HP5J, AFN Frankfurt, Paris 15,340kc, PCJ 11,730kc.

Mr. E. Moore. Kuala Lumpur, LRX1, HS8PD, CE622, CE970, CE1190, TAP, Liepzig.

Our Own Listening Post. CR7AB 3490kc, Johannesburg 3450kc, HJDE, ZJA6 15.085kc (1st report from Australia), CXA10, WRUW 9570kc, CE1180 5780kc, ERA 4845kc, Singapore 21,720kc, VLB11, LLN 17,825kc. Radio France Hanoi 9465kc (1st report from Australia), 6048kc (1st report from Australia).

READERS' REPORTS

THE following readers have written us regarding their short wave loggings during the past month.

Master P. Kayser, West End, Qld.; Mr. K. Franks, Adelaide, SA; Mr. G. A. E. Major, Manjimup, WA; Master R. Rooke, Manly, NSW; Mr. W. Jeffcott, Springwood, NSW; Mr. H. Webley, Lower Hutt, NZ; Mr. H. Cox, Cobden, NZ; Mr. H. N. Philp, Bankstown, NSW; Mr. M. Krumbeck, Carlton, NSW; Mr. A. Cushen, Invercargill, NZ; Mr. A. R. Pettiford, Ashfield, NSW; Mr. D. A. Hickey, Petone, NZ; Mr. R. E. Smallwood, Eastwood, NSW; Miss D. Sanderson, Malvern, Vic.; Mr. D. B. Knock, Waverley, NSW; Mr. L. D. Corstorphine, Forster, NSW;

NEW STATION LOGGINGS

Call	KC.	Metres	Location	Time heard
KNBA	6065	49.46	Dixon, Cal., USA	7.30 pm
WLKS	6085	49.30	Kure, Japan	8.00 pm
12R01	6085	49.30	Rome, Italy	6.00 am
Radio Douala	7950	37.74	Douala, Cameroons	4.30 am
CR6RB	9165	32.73	Benguela, Angola	5.00 am
WOOW	9700	30.93	New York, NY, USA	7.30 am
OTC2	9780	30.67	Leopoldville, Bel, Congo	6.30 am
VPO3	10605	28.29	Bridgetown, Barbados	7.00 am
WNRX	11830	25.36	New York, NY, USA	7.30 am
WOOC	15130	19.83	New York, NY, USA	7.00 am
VLB11	15160	19.79	Shepparton, Vic.	7.45 am
ZL4	15280	19.63	Wellington, NZ	8.00 pm
VLB11	15320	19.58	Shepparton, Vic.	7.45 am
WLWR	15350	19.54	Cincinnati, Ohio, USA	7.30 am

VP03—BARBADOS

A NEW B.W.I. STATION

THE West Indies has been well to the fore recently with regard to new stations and another to add to the list is VPO3 in Bridgetown, Barbados, which we have heard on two or three occasions operating on 10,605kc.

The first morning we heard them was at 6.30 am, when they were playing records continuously without announcement. Our first thought was that at last we had logged ZIK2, in Belize, Honduras, which uses 10,600kc. However, at 6.50 am the station went over to speech and began a description of horse racing.

This continued until after 7.0 am, when the station closed down with a very clear announcement as follows:—"We would remind listeners that you are listening to station VPO3, in Bridgetown, Barbados, transmitting on 10,605kc, 28.29 metres. This station is owned and operated by Cable & Wireless (WI) Ltd. We shall be on the air again on Saturday when we will transmit the first race at 5.30 pm. Hello, Trinidad, we hope you received this broadcast OK and wish you all good evening!" At the conclusion of this announcement the station closed with a march.

SHORT WAVE NOTES for the February issue are due on January 9. For the March issue they are due on February 6. Please send them direct to Mr. Ray Simpson, 80 Wilga-street, Concord West.

We listened again on Sunday morning and, sure enough, the Saturday afternoon transmission was heard at quite good strength though there was quite an amount of interference from the Rocky Point station, WQW.

We understand that Cable & Wireless Ltd. have another Bridgetown station on 19,055kc and on another morning in the following week we heard a station on that frequency playing records continuously but it faded out completely before any announcement could be heard. We feel sure that VPO3 will verify any correct reports they may receive from Australia and hope that we may even receive ours in time to include in this month's issue. While speaking of the West Indies, we have not heard ZJA6 on 15,085kc for some time now, so perhaps they are now using another channel.

STATION ADDRESSES

COHI.—Estacion COHI, RHC Cadena, Parque Vidal 5, Santa Clara, Cuba.

COCY.—Estacion COCY, Radio Cadena Azul, Barque Vidal 5, Santa Clara, Cuba.

TIEP.—La Vox del Tropico, Apartado 257, San Jose, Costa Rica.

Radio Tetuan.—Radio Tetuan, El Director del Prensa, Propaganda y Radio Tetuan, Tetuan, Spanish Morocco.

TFJ.—Iceland State Broadcasting Service, PO Box 547, Reykjavik, Iceland.

ZOY.—C/o Chief Clerk, Broadcasting Department, PO Box 250, Accra, Gold Coast.

AFN Frankfurt.—HQ US Forces European Theatre, 7706 American Forces Network, C/o APO 757, C/o PM, New York, USA.

Radio France.—Le Directeur, Radio France, 56 Rue Richaud, Hanoi, French Indo China.

VLW.—Australian Broadcasting Commission, PO Box D 190, Perth, West Australia.

HP5B.—Radio Miramar, Apartado 910, Panama City, Panama.

SUMMARY OF AFRICAN STATIONS

WE have received a very interesting letter from Mr. Mervyn P. Laubscher, who is one of the best known South African listeners, and in it he gives details of some of the lesser known African stations of which he has first-hand information. This month, therefore, we will summarise the stations in this Continent and incorporate the details kindly sent by Mr. Laubscher

ANGOLA. Radio Club de Angola is perhaps the most widely heard and they operate the stations CR6RA on 9470kc, and CR6RL on 15,895kc. They also have an outlet, CR6RN, but it is difficult to decide as to what frequency it is on as the information from the station is not correct as they give it as 9742kc

Another of the Angola radio clubs, the Radio Club of Benguela, operates two stations, CR6RB on 9165kc (reported in this month's issue as heard over here), and CR6RF on 7054kc which operates in parallel. This station, whose address is Caixa Postal 19, Benguela, sends a very attractive verification card printed in green with a map of Africa in white. A grey elephant stands at the bottom pointing its trunk to Benguela. The call letters are across the top in red and on the reverse side are verification details.

Still another Angola station is CR6RE which is operated by the Radio Club de Malange and uses 7140kc as its frequency. Their schedule is 10.0 pm to 10.45 pm, and 5.30 am to 6.30 am on week days and 5.0 pm to 6.0 pm, 10.30 pm to 11.30 pm on Sundays.

MOZAMBIQUE. This has always been one of the best heard of the African countries and there always seem to be some of the Radio Club of Mozambique signals audible in the early mornings. Here is the latest schedules of their stations as received from Mr. Laubscher:– English programmes daily on CR7AB, 3490kc, from 3.0 am to 8.0 am and also over CR7BV on 4925kc. There is an extra transmission on Sundays from 5.0 pm to 10.0 pm on CR7BE on 9710kc. The Portuguese programmes are carried on CR7BJ, 9645kc, from 3.0 pm to 4.0 pm, 7.30 pm to 9.30 pm. For their next transmissions they also use CR7BU on 4873kc and these are heard from 2.0 am to 6.0 am. CR7BJ is very good indeed at our location around 4.30 am and the station can be easily identified as being in Lourenco Marques.

Another Mozambique station is CR7IB, which uses 7155kc, and the latest advice is that they are purchasing new and higher powered equipment, so should be heard more easily in this country.

BELGIAN CONGO. The Leopoldville stations are coming in very nicely now over OTC2 on both 9745kc and 9785kc, the latter being a new outlet heard in the session in English which opens at 6.30 am. Prior to using 9785kc there was a station also announcing as OTC2 which used 11645kc, but it is no longer on the air. In the afternoons one can sometimes hear another of the Leopoldville stations, OTM2, which operates on 9380kc, but strength is not nearly as good as the 9745kc or 9785kc channels. We have not heard OTC5 in the 16 metre band for some time now.

Another station which operates in the Belgian Congo but which has not been reported in Australia we think, is Radio Elisabethville on 11,900kc using 150 watts. The call letters for this station are OQ2AB for both the above mentioned frequency and also for their 50 watt transmitter on 7149kc. They operate only from 11.0 pm Sunday till 1.0 am Monday, so we do not think there is much chance of hearing them here, especially on these two frequencies. If anyone should be fortunate in logging them, their address is PO Box 1038, Elisabethville, Belgian Congo.

A new station reported by Mr. Laubscher is Radio Congolia, using the call of OQ2RC on 9210kc and operating from 5.0 am till 5.30 pm daily. Signs on and off with Belgian National Anthem.

SOUTHERN RHODESIA. In this colony we have Salisbury, which uses 3700kc and 6100kc, the first from 7.30 pm till 9.15 pm and the latter from 2.0 am till 6.0 am. The same programme is broadcast from the Bulawayo station on 3800kc. We do not receive many reports of any of these stations being heard in this country.

NORTHERN RHODESIA. This colony has been well in the forefront recently with their broadcasts from ZQP on 9710kc and 7220kc. The power of the 9710kc outlet is 2½kw and the 7220kc one is 500 watts. Their schedule is weekdays from 1.0 am to 3.0 am and on Sundays from 7.0 pm till 8.30 pm and 1.30 am to 2.30 am (Monday). The 9710kc channel comes in very nicely now at our location.

FRENCH EQUATORIAL AFRICA. The stations located in Brazzarville are among the best heard of the Africans at the present time and we enjoy the quality of the programme they give from 6.30 am which is followed by news in English by a very clear spoken announcer over FZI on 11,970kc. They can also be heard at the same time on 7000kc but strength is not nearly as good. The other two outlets are on 9440kc and 9980kc but are never particularly loud in the mornings.

MADAGASCAR. The Tananarive stations have improved a lot during the past few months, and in the very early hours of the morning both the 6065kc, 9695kc and the 10,615kc channels can be clearly logged.

SENEGAL. Radio Dakar is now heard easily both in the mornings around 7.0 am and better still in the afternoons around 5.0 pm when they use 11,715kc. The programmes are all in French but as they frequently announce Radio Dakar it is not difficult to identify this station. Verifications are arriving in this country now, which is very pleasing as they did not verify for quite a long time.

SUDAN. The Omurman stations have been heard quite consistently for some time now and just now are quite strong on 9645kc around 1.0 am, though at that time there is no sign of their other outlet on 13,320kc, which is supposed to be in parallel.

KENYA. One of the oldest African stations is Nairobi, which used to, and perhaps still has, the call VQ7LO and is operated by Cable & Wireless Ltd. For a long time they operated on 4950kc and then moved to 4885kc and then made a further move to 4855kc. We were very disappointed to receive a reply to our report on this frequency to the effect that they were not on 4855kc but 4885kc.

This is one more example of lack of co-operation between the engineering and office departments of a station and rather exasperating to listeners. Despite what they say, this station was definitely on 4855kc and we will write to them further on the matter in the hope that they will admit it and send a correct verification.

SOUTH AFRICA. The South African Broadcasting Corporation stations are consistent but never at very good strength over here. Possibly the best is Johannesburg on its summer frequency of 4895kc. The schedule of this station is, 1.50 am till 7.05 am and is usually good to fair at closing.

Another Johannesburg station is the one on 9870kc which can sometimes be logged between 1.30 am and 2.10 am when they close. According to Mr. Laubscher the 10,540kc frequency is not used any more and 11,710kc is not used yet. The Durban station which operated on 6170kc has now been dismantled so there is no chance of hearing that one. The SABC are always very courteous and verify all correct reports.

ETHIOPIA. The Addis Ababa station on 9620kc can still be heard on a Monday morning around 2.0 am with a Church service in English and by such can easily be identified. Strength of signal is good and the channel clear. We have had no further reports of the station on 15,075kc, so there is perhaps some delay in its reported move to operate regularly.

MISCELLANEOUS. Among the other Africans which are heard from time to time are Radio International on 6200kc located in Tangier, the Ponta Delgado stations on 4845kc and 11,090kc, all heard in the mornings. ZOY Accra, on 7300kc, can sometimes be heard around 3.30 am as also can CNR3 in Rabat, Morocco, which uses 9080kc.

NEWS FLASHES FROM EVERYWHERE

LIBYA. We are indebted to Graham Hutchins, of Radio Australia, for details of a new station which is said to be operating from Benghazi in Libya. This new one is a Forces Broadcasting station and announces as being on 11,850kc but is actually nearer 11,820kc. It relays the Forces station on 833kc and is on the air from 3.0 pm till 4.15 pm, 7.0 pm to 9.0 pm, 11.0 pm to 2.0 am, 4.15 am to 7.0 am, and then from 7.0 am till 8.0 am carries its own test programme. Unfortunately it is difficult to receive, due to GSN, except in the first and last session. They are anxious to receive reports, which should be addressed to Forces Broadcasting Station, Benghazi, MELF.

HOLLAND. Readers will remember the contest which station PCJ conducted from 30th March this year, when they celebrated their 20th year of operation. Mr. D. B. Knock, of Philips, has kindly informed us of the results, which were as follows:—1st Prize, free round trip by air to Holland, Miss Elisabeth Holland, St. John's, Newfoundland; 2nd Prize, Philips All Wave Receiver AERO-DX, Lt.-Col. D. M. C. Morrison, HQ Northern Command, India: 3rd Prize, Philips amplifier, Miss Margaret Boyd, 50 Darebin-street, Heidelberg, N.22, Victoria. Mr. Knock points out that PCJ is now under the administration of the Wereldomroep, the new Netherlands Overseas Service. PCJ was built by Philips Organisation and operated by them until the advent of World War II.

SIERRA LEONE. This West African colony is reported to be operating a short wave transmitter on 8125kc on Monday mornings only, from around 1.30 am. They carry out tests prior to opening a radio telephone service to Bathurst, Accra, and Lagos. The transmitter is said to be a Marconi SWB-8E using 1kw, and the call has been reported as ZHV5. Reports are requested and, we imagine, would be readily verified. While dealing with Africa, we note from Graham Hutchins that Radio Douala, in the Cameroons, is said to be operating again on 7950kc from 4.0 am to 6.0 am. We believe this station was heard in Australia round about 1940, but cannot remember who was the successful listener at that time.

SOUTH AFRICA. A very interesting station has recently opened in South Africa, this one being ZRB on 7445kc. This station is operated by the South African Air Force and is located at Waterkloof, in Pretoria. This station, which has a power of 5kw, is intended primarily to broadcast weather reports, aviation and ionospheric information but also has musical interludes. Reports are wanted and should be addressed to Officer Commanding, 64 Air School, Air Force Station Waterkloof, PO Odonata, District Pretoria, South Africa. The writer has heard a station on this frequency, rebroadcasting the BBC around 2.30 am, and this may be ZRB. A report has been sent to the station so in time we will know if it was this station or not.

NEWFOUNDLAND. Very little is ever heard from this North American colony as few listeners seem to hear either of their two short wave stations VONG and VONH. We are indebted to Radio News for the latest schedule of VONH, which operates on 5970kc 11.30 pm to 3.30 am, 7.30 am to 1.30 pm. Although power is only 300 watts, it has had reports of reception from England, Gibraltar, North Africa, Greenland, Australia and Barbadas. The studios are in the Newfoundland Hotel, St. John's, and the programmes are fed by underground cables to the transmitter at Mount Pearl, a park about six miles away. Listeners should keep a watch for this interesting station as it is occasionally heard at fair strength.

NORWAY. In a recent verification received from the Norwegian Broadcasting Administration for LLN on 17,845kc, they advised the writer that they had only used their 13 metre outlet for experimental transmissions on odd occasions and at the present time had no plans for putting it into use in the future. The latest schedule we have for the Norwegian stations is LKV 15,175kc, LKQ 11.735kc and LKJ 9540kc from 8.45 am to 10.35 pm and 2.0 am to 8.0 am. Another station which has been reported in the USA is LCR, which has been heard calling New York on 19,930kc. This is a telephone station but we think it would be verified if anyone is lucky enough to hear it.

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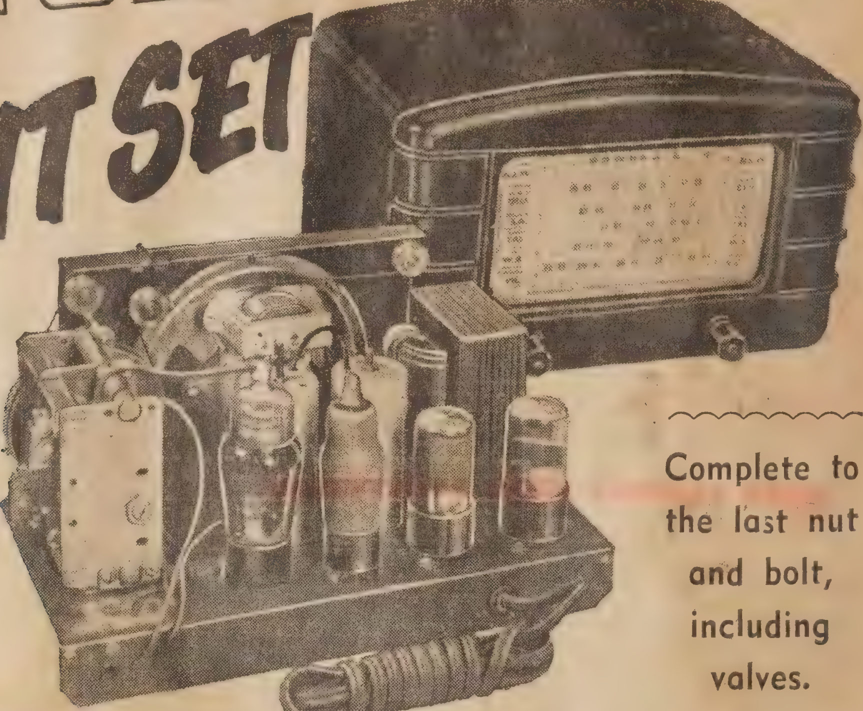

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THIS MONTH'S VERIFICATIONS

HJDE, COLOMBIA. This South American station which operates on 6145kc and has been heard on some nights during the past few months, sends out a quite attractive card. On the address side is a view of the towers of the Church of the Candelaria and aslo a number of slogans in Spanish, telling of the many virtues of the city of Medellin. On the reverse side is their title "La Vox de Antioquia," and their broadcast call letters, HJDK, 1250kc and the short wave call, HJDE, 6145.3kc. Beneath this is the verification details which are all in Spanish.

TABRIZ, IRAN. Rex Gillett has just informed us that he has received his verification from Radio Tabriz, for 6090kc. In their letter they say, among other things: "This is the first correspondence we have had with Australia and herewith are pleased to let you know about it. The broadcast which has been the fortune of our receiving this letter from you, is a part of our broadcast which was transmitted from the Opera House of Tabriz."

The address for this station is Department of Propaganda and Employment and Radio, Tabriz, Iran.

RADIO EIREANN, EIRE. We recently commented on the fact that Radio Eireann was a very difficult station to log and also that there were not many verifications received for reception. The industrious Rex Gillett now tells us that he has just received his verie for their 9595kc transmission which he heard last June. Mr. John O'Keefe, of the station, says in his letter, "Your report is most helpful and we shall be glad at all times to hear how the Irish transmissions are received in Australia."

The station advises that news in English is broadcast daily on 17840kc, at 3.30 am and on 9595kc, at 7.10 am.

MADRID, SPAIN. Another station which has been very slow in verifying listeners' reports is Radio Nacional de Espana, in Madrid, which has been heard so well on 9368kc. Max Krumbeck now advises that he has received both a verification card and also two little booklets which he kindly sent for our inspection. The card shows a photo of the studios on the one side and on the reverse, is an acknowledgment, signed by E. Thomas de Carransa, Director of Programme and Broadcasts.

The power of the short wave outlet is 40kw, while the broadcast band transmitter uses 120 kw. In the booklet they state that every Thursday, Mr. Stuttard, correspondent of Kemsley Newspapers, in Spain, broadcasts an interesting description of various aspects of life in Spain.

RADIO FRANCE, HANOI. We had nearly given up hope of receiving a verification from this station, so when we received a letter recently from the station director, Monsieur P. Farines, we were particularly pleased. The letter was in French and apologised for the delay in answering our letter of 2nd July, reporting their 9465kc transmission and our second letter of 9th September reporting their change to 6048kc.

After verifying both reports, the director offered his congratulations on our double success in being the first Australian listener to report reception of both their frequencies. He also advised that the other Indo China station which we know as Radio Vietnam, is really Radio Viet Minh, and is a clandestine mobile station operating in the north of Indo China.

ZPA3, PARAGUAY. We have just received word of a very interesting verification which Arthur Cushen has recently received. This one is for ZPA3, which is located in Asuncion, Paraguay. They sent a very nice card by air mail. On this card is a very clear photograph of their transmitter buildings and huge lattice mast. In the sky are printed details on one side English, and on the other, Spanish. The title of the station is "Radio Teleco" and shown on the card also, is the broadcast call ZP3, 700kc and ZPA3, 11870kc. The address of this South American is Estacion, ZPA3, "Radio Teleco," Azara 56, Asuncion, Paraguay. This is a card well worth going after, as it appears to be very attractive.

WITH OUR SHORT WAVE REPORTERS

Mr. MAX KRUMBECK

In the first few of these articles concerning our many short wave reporters we have included some of the better known listeners, but it is our intention to devote space to all readers who are kind enough to forward us regular reports. We therefore have pleasure this month in giving some details of one of our newer NSW listeners, Mr. Max Krumbeck, of Carlton.

In future issues we will cover other readers in all the Australian States and also some of our New Zealand friends.

Without further preamble we will let Max Krumbeck tell us of his experiences since he took up the hoppy.

"Being a newcomer to the grand hobby of short wave DX listening, it came as a surprise when I was asked to tell of my experiences for this month's issue. However, I am only too pleased to give what details I can of how I first became interested.

It all starts early last year when, on my discharge from the RAAF, I decided to listen to old favorites I had heard during the war. Prior to that, short wave broadcasts were completely unknown to me. Unfortunately, my new found hobby clashed with the wishes of the family as, when I wanted to explore the short wave bands, they quite naturally wanted to listen to their favorite stations on the broadcast band. Round about that time, 'Radio & Hobbies' fortunately came to light with the 1946 version of the General, and by the time I had my version of that receiver in operation, it coincided with the February issue which contained an article written by Ted Whiting on how to obtain verification cards, &c.

The first verifications I received were from Noumea and KWID and I had nearly given up hope after waiting for over two months for them. However, during the following year I was to learn of how long it is sometimes necessary to wait until your QSL card does turn up.

The Little General was working exceptionally well and during the first twelve months I was using it I managed to log 107 short wave stations, verify 64 of them and miss out on 12.

(Five of the latter were to Moscow—someone should have warned me!) The antenna in use at that time was an inverted 'L', 40 feet high, NE-SW.

Shortly after this, the opportunity presented itself to obtain a six valve receiver ex Disposals, and since that time I have brought my total verifications up to 96 from 21 different countries. Just now I also have reports out to 64 other stations, so I should be well past my first 100 before very long. The local interference is very bad at my location and I have erected a doublet antenna in an effort to overcome it as much as possible.

My listening time is mainly at night when I usually run over the dial from around 7.0 pm till 10 or 11.0 pm, though occasionally, I see what is on the air in the early morning, but prefer to listen at night whenever it is convenient.

My chief interest is in logging new stations, and here it is my ambition to obtain at least one first report from Australia verification, quite recently being beaten into second place for one of the Singapore outlets.

To the best of my knowledge I have only had three calls over the air, these being from PCJ, CHOL and YHN, the latter promising a card which I am anxiously awaiting as they seem to be something of a rarity. I have had the usual number of failures and errors, but these are being gradually overcome.

One of the greatest features of this grand hobby is the friendly maner in which most stations asknowledge reports from listeners, so much so that they become old friends and it really is a pleasure to hear from them.

When I first began listening I must admit I did not have the patience to listen to the very weak stations but since I have succeeded in logging some of the elusive Africans and South Americans I have become a really keen DX listener, and as such, willing to go after a station no matter how weak its signal may be.

As a beginner I do not feel confident to offer advice, but to me the main thing seems to be the report that counts, and so long as it is clear and complete one cannot go far wrong."

Readers will agree that Max has done remarkably well in the short time he has been listening and we all wish him the best of luck in the future.

Next month we intend to feature one of our Western Australian listeners as we feel that the Western State does not receive the attention it perhaps should. There are some very fine listeners over there and no lack of enthusiasm.

SOME NEW STATIONS THIS MONTH

BELGIAN CONGO. During the last week or so the Leopoldville short wave station has been using an additional transmitter in parallel with the one on 9745kc, which has been heard so well of late. This new one is on 9785kc, not far away from the other one, which has been known as OTC2. According to the American magazines, the outlet on 9785kc is also OTC2, but we do not have much faith in the announcers of this station, as we have heard them announce their frequency as 17840kc when they have been on 9745. Listen for the new one around 6.30 am when they begin their transmission in English directed to the British Isles, &c.

USA. Quite a number of the United States stations have taken into use new channels for certain of their transmitters and among possibly others, we have noticed, WNRX, on 11830kc, very good, till closing at 8.0 am, WLWR, on 15350kc, also good, when closing at 8.0 am, KNBA, 6060kc, excellent every night from 7.30 pm and WOOC, on 15130kc and WOOW, on 9700kc, both with very good signals around 7.30 am.

The majority of the above stations are used in the Voice of the USA programmes, though the last two mentioned, are used to carry the United Nations' discussions at Flushing Meadow. There may be a few others which have changed frequency, as it is hard to check unless one spends a fair amount of time with them.

JAPAN. The BCOF station located at Kure, WLKS, has once again had to make a change in frequency, this time to 6085kc. Prior to using this channel it was working on 6065kc, but we imagine it was due to KNBA opening on 6060kc that made the change necessary. When this station originally came on the air it was using 6105kc, but after a time changed to 6065kc.

Thanks to Sgt. K. Morehead, of BCOF, we have the November schedule of this station, which shows its hours of transmission to be, Mondays to Friday, 7.30 am to 11.30 pm, Saturday, 7.30 am to midnight and Sunday, 8.30 am to 11.30 pm. Programme consists of News, Variety Shows, Devotional broadcasts, Children's session, Talks and a Women's session. **STOP PRESS:** WLKS has now moved back to 6105kc.

CAMEROONS. This French African colony is a good catch at the present time and if you listen on 7950kc around 4.45 am you will hear Radio Douala at quite good strength. All announcements are in French and at 4.45 am they give a news session, which supplies good material for a report. From 5.0 onward, they have musical numbers and as some of these are popular American recordings with the chorus in English, it is quite easy to obtain more details for your letter.

THE HAM BANDS WITH BILL MOORE

The general regulations covering amateur stations issued at Atlantic City vary little from those listed at Madrid and Cairo. One interesting change is the waiving of the code test in the case of stations using frequencies of 1000MC and above. The change is at the discretion of the various countries, but will mean introduction of a new type of "UHF amateurs.

IT can be seen from the following text of the regulations that much is left to the local governing authority.

1. Radio communication between amateur stations of different countries shall be forbidden, if the administration of one of the countries concerned has notified that it objects to such communications.

2. A.—When transmissions between amateur stations of different countries are permitted, they must be made in plain language and must be limited to messages of a technical nature relating to tests and to remarks of a personal nature for which, by reason of their importance, recourse to the public tele-communications service is not justified. It is absolutely forbidden for amateur stations to be used for transmitting international communications on behalf of third parties.

B.—The preceding provisions may be modified under special arrangements between the countries concerned.

3. A.—Any person operating the apparatus in an amateur station must have proved that he is able to transmit and receive by ear, texts in Morse code signals. Administrations concerned may, however, waive this requirement in the case of stations using exclusively, frequencies above 1000 Mcs.

B.—Administrations shall take such measures they judge necessary, to verify the qualifications, from a technical point of view, of any person operating the apparatus of an amateur station.

4.—The maximum power of amateur stations shall be fixed by the administration concerned, having regard to the technical qualifications of the operators and to the conditions under which these stations must work.

5. A.—All the general rules of the convention and of the present regulations shall apply to amateur stations. In particular, the transmitting frequency must be as constant and as free from harmonics as the state of technical development for stations of this nature permits.

B.—During the course of their transmissions amateur stations must transmit their call sign at short intervals.

AUSTRALIAN AMATEURS ANTARCTIC EXPEDITION

ON board HMAS LST 3501, which left for the Antarctic recently, are three Victorian amateurs, VK3ACD, VK3AMG and VK3OY. The vessel left for Heard Island in the Great Southern Ocean, practically due south of India on Lat. 52 degrees. Operation of these stations will not be permitted as mobile marine stations, but will be limited to transmissions from the island. All three have equipment with them and will use their Australian call signs.

The Federal executive of the WIA is negotiating with the Department of Navy for permission to operate mobile marine from the "Wyatt Earp," another vessel of the expedition, which will leave in the new year for Macquarie Island, south of Tasmania. These stations should provide some interesting contacts for the world's amateurs.

AUSTRALIAN NATIONAL FIELD DAY — 1948

NATIONAL Field Days throughout the world provide amateurs with an opportunity to really try out their portable equipment. WIA National Field Days prewar were immensely popular and the 1948 event should be well supported. It will be run over the long weekend in January, commencing at 1500hrs. EAST on Saturday, 24th, and conclude at 2359hrs. on Sunday, 25th. A summary of the rules for the benefit of intending competitors is as follows:—

The contest is limited to portable stations within Australia and the Mandated Territory.

A portable station for the purposes of the Field Day is defined as one whose power is not obtained from either private or public mains and shall not be located closer than five miles from the home location of the operator and shall not be situated in any occupied dwelling.

No apparatus is to be set up on the site earlier than six hours prior to the start of the contest.

Any number of operators can operate the station, but they must be licensed.

Any number of transmitters can be used, but only one at a time.

"WIA NFD" should be used frequently when calling, to indicate a portable station.

Sections.—There shall be three sections, Open, CW and Phone. The Open to consist of both Phone and CW operation. Separate logs must be submitted for each section for which the station is entered.

Operators will choose the best consecutive 24 hours of operation from the total 33 hours of operating time. Lesser periods than 24 hours may be worked.

Logs must show the location of the portable, name and callsigns of the operators, a description of the transmitters, receivers, antennae and power supplies. The power input to the final stage with antenna connected must not exceed 50 watts.

Logs are to show, in sequence, date, time, station worked, band, report out and in, contact points claimed and bonus points claimed. A summary at the end of the log would help checking.

The completed log will be signed by the operators and endorsed with a statement that the rules have been adhered to.

Scoring.—Separate districts will consist of VK2, VK3, VK4, VK5, VK6, VK7, Northern Territory VK5, and Mandated Territory VK9.

Contacts within a district will not count as a score and an exchange of RST must be made before points are scored. Points will be awarded as follows:—

A.—For contacts with a fixed station within the Commonwealth outside the competitor's State: 1 point.

B.—For contacts with stations in Asia, North America and Oceania (outside Australia): 3 points.

C.—For contacts with stations in Europe: 5 points.

D.—For contacts with Africa and South America: 7 points.

E.—For contacts with other portable stations in the contest outside own State: 10 points.

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F.—For every two-way contact using frequency modulation, add 3 points to above contacts.
Add to final score 25 points.

G.—A bonus for each continent worked on each band (1ARU map for boundaries):

H.—A special bonus for each interstate or overseas contact on, or above 50mc band: Add to final score 50 points.

Awards.—A special certificate will be awarded to the outright winner in each section, the Open, Phone and CW sections.

A suitable certificate will be awarded to the sectional winner in each district or which the outright winners, as above, are not eligible.

Logs should be in the hands of the Federal Executive not later than 15th February, 1948.

ATLANTIC CITY

WHILE no further news of decisions of the ITC is available at the moment, a few points of interest crop up and could be commented upon.

We have heard of the frequency allocations under Zone 3 which includes Oceania. The exact position will not be clarified until the Australian authorities make a statement on our bands widths.

It is a matter for conjecture when these new frequency bands will come into force. If we are to judge from the time it took to bring them into line after Cairo, it will not be until late in 1948 or even 1949 before we change over. After the Cairo ITC was ended it was about 18 months before changes of frequency were enforced.

WE note with deep regret the passing of Ted Clune, VK2DK, on December 1. He was one of our most active amateurs, always alive to what went on, helpful to others, staunch in his belief and friendship. We offer our deepest sympathy to his relatives and friends.

It must be appreciated there is much initial groundwork to be done before changes can be made. Seventy-seven Governments must re-align the whole of their communications set up.

The world found itself very short of callsigns and the three letter call blocks CAA to ZZZ have been extended to run from AAA to ZZZ.

Quite a few new nations come into the picture—Republic of Philippines, Outer Mongolia and Pakistan and the Indian Dominion—and have to be taken care of.

The AAA-ZZZ series has been further extended into a number series 2AA to 9ZZ. Some new amateur prefixes are likely to appear, Included in which a number will appear in the prefix and we could have 3ZHZ instead of VK2HZ, where 3Z would substitute for VK. Sounds a little strange for a while.

THE UHF's

STATIONS in the Eastern States had a regular "picnic" during the week 9 to 16 November. The 6mx band opening on many occasions for quite long periods. The peak was possibly on the evening of Thursday, 13th, when one Sydney listener heard 14 different VK4's and seven VK3's. Stations in Tasmania, Queensland, South Australia and Victoria were audible at different times during the week. NSW UHF officer, Charlie Fryar, VK2NP, offers a theory for this opening on the UHF's; he will propound it at a UHF meeting in the future.

The first long distance ground wave contacts in NSW, assisted possibly by a little temperature inversion, were made between VK2JU in Sydney and VK2TA, near Young, on Wednesday, 19th November. Both operating from their home QTH's they covered 180 miles. A few days previously they had contacted cross band with 2TA on 40mx. Signals along the path vary somewhat, but 2JU's signals have been up to S9 at times.

2JU has also been heard by 2PN at Tumut, just on 200 miles; 2GU in Canberra, about 140 miles; and 2TC Monteagle, 175 miles.

From results obtained it appears that the channel will be permanently open and with the erection of more elaborate arrays at both ends under way, signal strengths will be lifted even higher.

The acquiring of the SCR522's by the Queensland Division of the WIA from Disposals, should help greatly in the populating of the 6mx band and in influx is anticipated in the New Year.

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O.K. DELL, IT'S A DEAL
SIX MONTHS LATER
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OFF THE RECORD — NEWS & REVIEWS

By JOHN MOYLE

At the time of going to press, we had not received records from the January lists. Below are some of the more recent recordings now available

REGAL-ZONOPHONE

LEON PAYNE Singing with Guitar—"Let It End This Way" and "'Neath the Old Pine Tree." G.25165.

KAY KYSER AND HIS ORCHESTRA—"What Are You Doing New Year's Eve?" and "My Pretty Girl." G.25169.

STEVE CONWAY (VOCAL) WITH ORCHESTRA—"The Stars Will Remember"

THE RHYTHMIC TROUBADOURS—and "Beware My Heart." G.25170.

"You Went Away and Left Me" and "The Little Old Mill" (Went round and round). G.25171.

JOHNNY BOND AND HIS RED RIVER VALLEY BOYS—"You Brought Sorrow to my Heart" and "The First Rose." G.25172.

KINDERGARTEN MUSIC TIME SERIES—Music for Rhythms (Z. R. McHenry)—(Part 1): 1. Pony Ride; a. Flying Music; 3. Thunder Music; 4. Raindrop Dance, 5. Running Music.—(Part 2): 1. Aeroplane Music; 2. Soft Sway; 3. Medium Sway; 4. Wind Music; 5. Slip in C. G.25167.

(Part 3) 1. Walk II and IV; 2. Train Music; 3. Skip; Off We Go; 4. Waves; 5. A.-Galloping-O. (Part 4); 1. Slow Walk; 2. Two-Four Time; 2. High and Low; 4. Loud and Soft; 5. Jack in the Box. G.25168.

FLOYD TILLMAN (Vocal with String Band Accompaniment)—"Go Out and Find Somebody New" and "Gotta Have Somethin'." G.25166.

THE HARMONIQUES (VOCAL QUARTETTE WITH GUITAR)—"Blondie" and "Reading Over Your Shoulder." G.25174. "She's Got to be Five Foot Two" and "Carefree." G.25175.

H.M.V.

JACK PAYNE WITH HIS ORCHESTRA—"We'll Gather Lilacs" and "Imaginez" (Is it a Dream?) EA.3597.

FREDDY MARTIN AND HIS ORCHESTRA—"When the White Roses Bloom in Red River Valley" and "Lady from 29 Palms." EA.3608.

BERYL RAVIS WITH ORCHESTRA—"I Want To Be Loved (But Only by You)" and "Please Be Kind." EA.3609.

TEX BENEKE WITH THE MILLER ORCHESTRA—"My Young and Foolish Heart" and "Feudin' and Fightin'." EA.3601.

DESI ARNAZ AND HIS ORCHESTRA—"Babalu'" and "Peanut Vendor." EA.3602.

TONY MARTIN WITH ORCHESTRA—"Don't Tell Me" and "You're Not So Easy To Forget." EA.3603.

MCKINNEY'S COTTON PICKERS — Hot Jazz Classics No. 13. — "Milenberg Joys"—L. Curl, B. Lee (Tpts.); C. Davidson, C. Jones (Tmbs.); D. Redman, M. Senior, G. Thomas, . Robinson (Reeds); T. Rhodes (Pno.); D. Wilbourn (Bjo.), B. Escudero (Bass); C. Auston (Dms.). Recorded 11th July, 1928, and "Shim-me-sha-wabble"—Personnel same as other side plus J. Nesbitt (Tpt.). EA.3606.

JOE LOSS AND HIS ORCHESTRA—"Heartaches" and "The Little Old Mill" (Went round and round).

HRH PRINCESS ELIZABETH—"Twenty-first Birthday Broadcast Speech." REA. 3607.

FREDDY MARTIN AND HIS ORCHESTRA—"Come to the Mardi Gras" and "I Can't Get up the Nerve to Kiss You." EA.3596.

DINAH SHORE AND RUSS CASE AND HIS ORCHESTRA—"Always" and "What'll I Do." EA.3598.

CHARLIE BARNET AND HIS ORCHESTRA—"Southern Fried" and "Nowhere." EA.3599.

SPIKE JONES AND HIS ORCHESTRA—"Laura" and "When Yuba Plays the Rhumba on the Tuba." EA.3600.

SAMMY KAYE AND HIS ORCHESTRA—"The Turntable Song ('Round An 'Round, An 'Round)" and "Midnight Masquerade." EA.3604.

VICTOR MALE CHORUS—"When Good Fellows Get Together" and "Kentucky Babe." EA.3611.

GLENN MILLER AND HIS ORCHESTRA—"Guess I'll Go Back Home (This Summer)" and "Faithful To You." EA.3612.

WINGIE MANONE AND HIS ORCHESTRA — "Ochi Chornya" and "In the Barrel." EA.3613.

THE SKYROCKETS ORCHESTRA—"On the Old Spanish Trail" and "I Get Up Every Morning (What Do I Do?)" EA.3614.

PARLOPHONE

JOE DANIELS AND HIS HOTSHOTS IN "DRUMNASTICKS"—Alike as Two Peas" and "Shandy." A.7634.

DUKE ELLINGTON AND HIS ORCHESTRA—"Braggin' in Brass" and "The New East St, Louis Toodle-o." A.7636.

GERADO AND HIS ORCHESTRA—"Harriett" and "Whisper I Love You." A.7635.

HARRY PARRY AND HIS RADIO RHYTHM CLUB SEXTET—"Blues for Eight" and "No Gin Blues." A.7633.

THE ORGAN, THE DANCE BAND AND ME—"That's the Beginning of the End" and "(Give Me the) Moon over London." A.7637.

COLUMBIA

FRANKIE CARLE WITH RHYTHM SECTION—"If You were the Only Girl in the World" and "I Want a Girl (Just like the Girl That Married Dear Old Dad)." DO.3084.

HARRY JAMES AND HIS ORCHESTRA—"Moten Swing"—Parts 1 and 2. DO.3085.

VICTOR SIVESTER AND HIS BALLROOM ORCHESTRA — "We'll Gather Lilacs" and "Dancing Heart-beat." DO.8086.

OU PREAGERL AND HIS ORCHESTRA—"I'm Gonna Lasso a Dream" and "Oh! Oh! Maria." DO.3087.

THE CHARIOTEERS WITH ORCHESTRA—"You're Breaking in a New Heart" and "Rogue River Valley." DO.3088.

VICTOR SILVESTER AND HIS BALLROOM ORCHESTRA—"Heartaches" and "September Song." DO.3089.

DINAH SHORE AND FRANK SINATRA—"Tea for Two" and "My Romance." DO.3090.

HARRY JAMES AND HIS ORCHESTRA—"Something for Nothing" and "Who's Sorry Now." DO.3082.

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Irene Stancliffe

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(Continued from Page 45)

costed a friend and I with the question, "I don't suppose either of you gentlemen know anything about radio?"

Of course, a question in that form invites its own answer but, not being barefaced enough to deny it, I stalled for the next two minutes. Apart from the fact that I felt the local man had some claim on the job, I had no urge to put aside the scones and tea to fiddle with a radio. Another mere detail was that the only tools available were in the car kit and, as usual, all messed up with grease.

But it transpired that this lady was in a spot. The set had been given to her as a present and she really had neither the means nor the opportunity to have it done locally.

When I finally came face to face with the set, I realised that my attentions would have done a local man a good turn, anyway. It turned out to be an old regenerative job with a 27 regenerative detector, transformer coupled to another 27 and thence to a 71A output valve. This, with a cone speaker, completed the venerable line-up.

SPEAKER LEADS

As a preliminary, I had to repair the leads to the loud-speaker and untangle a few other wires which went variously to aerial, earth and earphone terminals. Ultimately my efforts were rewarded with a faint hum, which deepened to a more impressive roar when the adjusting screw on the magnetic reed was set properly. Finally, the cone had to be locked to the driving wire by tightening the holding nut.

The aerial was not at all pretentious and there was no earth, so that it was not surprising that little more was evident of incoming signals than a few moderately-strong heterodynes.

But allowing for the fact that the reaction control was "ploppy" in its effect, there was no hope of tuning any station at worthwhile strength.

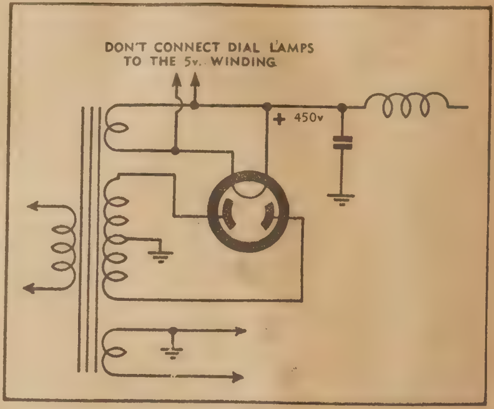
Next step was to provide an earth connection, which I improvised by running a third wire back to the earth pin on the powerplug. The earth connection cut the hum level to a reasonable figure, brought the signals up to barely audible volume, and smoothed out the reaction. Perhaps a very long aerial at this stage would have yielded reasonable results, but I had neither the time, the energy, nor the materials to shin up one of the local trees with this noble thought in mind.

WAVE TRAP

However, closer examination of the circuit revealed that the aerial entered the set through a wave trap arrangement and thence into the primary winding of the aerial coil.

The wave trap had obviously been incorporated with an eye to suburban listening conditions, but it was more of a hindrance than a help in this country district. Disconnecting it by "butchery" methods boosted the signal level a little, showing that the receiver simply wanted more signal input from the aerial.

Accordingly, I disconnected the wave trap tuning condenser altogether, and rewired the set so that the aerial was fed to the top of the grid coil through the now spare wave trap condenser. The condenser was set to about half value and—cheers—the stations rolled in, or whatever stations do on a 1927 model.



Showing how dial lights should not be connected in a receiver. This connection made the whole dial light assembly "hot," and is dangerous. Always use the filament circuit for dial lights.

More coupling capacitance gave higher signal strength but broadened the tuning and also limited the operation of the reaction control. Too little capacitance reduced the set to the same general performance as with the direct aerial coupling. So I set the aerial condenser to the optimum position and left the lady with a set which can at least tune a few stations. Yes, we certainly have progressed in radio during the past 20 years. Did I say twenty? Radio is becoming quite an ancient art, surely.

EMERGENCY CALL

The phone rang the other day, and the voice of a fellow serviceman greeted me, poignant with grief or some other emotion. From here on I paraphrase: "For Heaven's sake tell people not to connect dial lamps to the 5.0 volt winding."

You see it works this way. The dial lamps burn out a couple of times and John Citizen gets rather tired of replacing them. So he looks beneath the chassis and finds a winding on the transformer marked 5V, 2A. Being a canny fellow, he reasons that the lamps will still be quite bright enough on five volts, but they should last longer. It's not a hard job to make the change, and the set goes back into the cabinet for weeks or months.

But sooner or later something goes wrong and the serviceman is called in. Being also an industrious fellow, the serviceman grabs the chassis firmly with one hand and goes to screw the dial lamps tight with the other. The result is a nasty "belt," for the dial lamps are positive with respect to the chassis by the full high tension voltage.

You see, a 5.0 volt winding on a transformer is invariably used for the filament of the rectifier, and, such is the mechanism of rectification, that this filament becomes the source of high tension for the whole set. The potential is likely to be 450 volts positive.

Of course, if the rather mediocre insulation of the lamp holder breaks down, the short circuit may mean the end of your rectifier and power transformer. But, apart from that, it is a very quick and efficient way to get quits with the serviceman.

A "B" CLASS MODULATOR

(Continued from Page 68)

ing. Batteries are excellent, and we used three 9-volt C batteries connected in series.

You would be well advised to test out your modulator with an oscilloscope before using, to make sure everything is in order. An improperly adjusted B-class modulator can make a horrible mess of transmission, and splatter can be caused by distortion even although modulation percentage is below 100 per cent.

There should be no distortion of a sine-wave pattern round about the figures which we have mentioned. If there is, look to the input and output matching, and bias conditions. There is no harm in using a little more bias than specified as long as the tell-tale kink in the wave does not indicate cut-off conditions.

Should parasitics be indicated, a couple of 20-turn modulator grid chokes of 18-gauge wire, wound round a pencil and used self-supporting, should assist—also a 2000-volt working condenser of .002 mfds across the modulator output. We had no trouble from parasitics.

Compliment

ANSWERS TO CORRESPONDENTS

H.S. (Maryborough, Qld.) sends us details of his experiments with small receivers and relates his experience with an intermittent mantel set.

A. Many thanks for the encouraging remarks and details of your experiments which were read with interest. The phenomenon you mention was due to the volume control being connected in the feedback circuit. Thus the percentage of feedback depended on its setting. Ordinary commercial valve testers are not intended as precision instruments, but merely to give an indication of the valve's condition. The intermittent operation of the 6A8-G was probably due to an internal heating effect which did not occur in a larger receiver where a greater volume of air is available for cooling purposes.

G.H.E. (Mundoora, SA) sends in his subscription and expresses his views on battery valves.

A. Thanks for your subscription and you can rest assured that a due proportion of battery-operated receivers will appear in "Radio and Hobbies." The present series of 2.0 volt battery valves were designed for Australian conditions where long life and dependability are generally of more importance than extreme battery economy. The plate load resistor for type 1H6-G is .1 meg. This valve is intended mainly as a voltage amplifier and on its own would have neither sufficient gain nor enough output to operate more than a pair of headphones.

J.G. (Paddington, NSW) says he is very keen on the circuit of the "1947 Senior Radiogram" and asks about the inclusion of an extra I.F. stage and also the "R. and H." tone control unit with which he has had considerable success.

A. Provided you use I.F. transformers intended for the job, there should be no particular difficulty about incorporating two I.F. stages in this set. However, the gain of the individual stakes may have to be limited to preserve stability of operation. The chief difficulty about the tone control stage would be to prevent instability due to power supply feed back. Some trial and error would be necessary with decoupling therefore to ensure satisfactory operation.

R.N. (Mt. Isa, Qld.) writes in appreciation of "Radio and Hobbies" and asks a number of questions regarding a commercial receiver.

A. It is generally considered impractical to modify the short-wave coverage of commercial receivers. In addition the tuning condenser would not have sufficient capacity range to cover from 13 to 100 metres when it at present only tunes from 16 to 43 metres. It is impossible to give accurate directions as to how to connect a pick-up to your set without reference to the circuit diagram which unfortunately we do not have in our files. If your receiver was originally designed to use a .5 meg. potentiometer there is really no point in substituting any other value. We regret that without more precise information it is impossible to diagnose the cause of the squeaking effect. Many thanks for the kind remarks and we hope to live up to your expectations.

J.J. (Bankstown, NSW) tells of the excellent performance of his little set and asks whether a loop aerial could be used.

A. We note that you tried our previous suggestion of using two cells in parallel for the "A" battery, but are rather puzzled by your statement that the set oscillates under certain conditions when the two cells are in use. We trust that you have not made the unfortunate error of connecting the cells in series rather than in parallel. However, apart from this you appear to have done very well with this set, particularly as you are still using the low impedance earphones. To the best of our knowledge no commercial loop aerials are available at the moment with a reaction winding suitable to replace a Reinartz coil. However, you could wind up a loop yourself around the outside of the cabinet by following the directions we gave in connection with our baby portable "Tex" in the February, 1947, issue.

HOW TO SUBMIT YOUR QUERY

1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.
2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."
3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes and cutouts will be supplied if available for 2/6. Endorse envelope "Blueprint."

Address your letters to the Technical Editor, "Radio & Hobbies," Box 2728C, GPO, Sydney.

V.H.M. (Bororen, Q.) sends for a copy of the short-wave handbook and voices his appreciation of articles in "Radio and Hobbies."

A. Your copy of the Handbook has duly been forwarded, and we would thank you for your kind wishes. The 1K7G can be used quite successfully as a triode driver to a class "B" stage, although we would remind you that one other voltage amplifier stage would still be necessary between the diodes and the grid of the 1K7G. The operating bias with a plate and screen voltage of 135 is minus 4.5 volts.

J.J. (Drummoyne, NSW) writes in interest in the "Handie-Talkie" as featured in the October, 1947, issue of "R. & H." He suggests the publication of a suitable AC power supply for use with this little portable in the home.

A. We have had in mind, J.J., the idea of providing a battery-less power supply for the portable type of receiver. A number of points come under consideration, among which are regulation of the filament voltage for portables of all sizes, the comparatively short life of the miniature type valves under long periods of operation and the availability of a suitable transformer, rectifier and filter system.

N.McC. (c/o M.V. Salamaua) writes in appreciation of "Radio and Hobbies" and gives details of the sets he has constructed aboard ship. However, his latest portable brings in SW stations instead of the broadcast band as intended.

A. Many thanks for your letter which was read with interest. We sincerely hope our magazine continues to live up to your expectations. Your description suggests that the connections to the oscillator coil in the portable have been reversed. We suggest you thoroughly check this section of the circuit since it is probable that that is where the trouble lies. Incidentally, high gain miniature I.F. transformers are now available in this country.

R.E.L. (Indooroopilly, Q'ld.) reports having built up the "R. & H." "Auto Receiver" but found that considerable precautions were necessary to obviate interference problems.

A. Many thanks for your letter and we have arranged to reprint it at the first opportunity for what value your remarks may have for other readers.

L.McR. (Alexandria, NSW) reports having built up the "1947 Advance" but has experienced motor-boating trouble.

A. The original set gave no hint of any such trouble and we can only suggest that there is either an inadvertent error in the wiring or that some component is faulty. Check particularly the grid return circuits and the bypass condensers in the power supply. Try additional bypass condensers on the screens and cathodes of the valves, A.V.C. line and B-plus line. A .001 mfd condenser between the output plate and chassis may also help. The fact that you have constructed it as a mantel receiver may also have some bearing on the trouble due to feedback between "hot" leads. Leaving out the screen bypass condenser of the 6J7-G is not a real cure since its effect would be mainly to reduce the audio gain.

J.P.R. (Royston Park, SA) renews his subscription to "Radio and Hobbies" and requests a copy of the "Short-Wave Handbook."

A. Thanks for your subscription and for your suggestion regarding the cover picture. Copy of the handbook has been forwarded as requested.

D.F.Y. (Mendooran, NSW) requests socket connections for some disposals valves he has on hand and asks if type 1L5-G could be used in the output stage of the "1K5-Three."

A. We regret not having the information you require on the service valves. The 1L5-G would be quite suitable for use, as you suggest, and somewhat greater volume could be expected. The grid bias would need to be increased to 4.5 volts.

P.C.L. (Leura, NSW) expresses his appreciation of Radio & Hobbies both from the general interest and the radio amateur's points of view.

A. Many thanks for your kind remarks and we hope our magazine continues to live up to your expectations.

S.D. (Little Swamp, SA) was disappointed that our "Short-Wave Handbook" did not cater more for the needs of country listeners.

A. We realise that your remarks in this connection are perfectly legitimate but it was completely impossible in the time available to design a whole range of new receivers and transmitters as well as do all the editorial work associated with the station lists and other general information. As for the North American stations, that was an unhappy accident.

THE following reprints are available on application at our offices, 60-70 Elizabeth-street, Sydney. They will be sent, post free, on receipt of stamps or postal notes.

How to build a Synchronous Clock.	4 Pages	1/-
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Build Your Own Windcharger.	8 Pages	1/-
Coil Details for Small Receivers.	1 Page	6d
Radio Circuit Symbols.	1 Page	6d
Collecting Verification Cards.	1 Page	6d.

ANSWERS TO CORRESPONDENTS

J.T.M. (Tamnun, WA), writes of his success with small receivers despite the lack of AC power and difficulty in obtaining manufactured chassis, cabinet, &c. He also encloses 2/- for a copy of the Short Wave Handbook.

A. Glad to hear of your success and you can rest assured that "R. and H." will continue to keep the needs of the country reader well in mind. The Short Wave Handbook should have reached you before you read this.

A.A.C. (Cockatoo, Vic.) likes to see articles written in a personal style. He recently completed the Xmas Portable and considers it better than any commercial set he has handled.

A. Many thanks for the kind remarks and we are glad to hear of your success with the portable.

K.B. (St. Kilda, Vic.) finds many useful ideas in "Radio and Hobbies" and looks forward to receiving his copy every month. He recently lent his recording gear to a friend who returned it with both motor and pick-up burnt out. He requests advice as to where to have them rewound.

A. We would suggest you contact the company who manufactured the unit. They will either do the job for you themselves or advise of a firm who can.

M.T.M. (Prairie, Q'ld.) considers "Radio and Hobbies" good value. He also sends in details of his recent set building activities.

A. Thanks for favorable comments and wishes for our continued success. We are glad to hear of the pleasing results you obtained with "All Wave Three" and "1Q5 Two" and wish you the same success with "Vibra Five." The original FS6 set was intended for use with headphones and the mechanical noise was of no importance. However, some sponge rubber and a little ingenuity may solve the problem. The Shortwave Handbook has been forwarded on to you.

C.M. (Woodenbong, NSW) sends in an advertisement and mentions change of address. He has successfully completed "Sergeant Major" but the EBF2-GT intermediate stage of his "Little General" tends to oscillate.

A. The advertisement has been attended to and your change of address duly noted. As the prototype of the Little General was perfectly stable we can only suggest that the layout is at fault. It is particularly important in the interests of stability to isolate the grid and plate circuits of a high gain I.F. stage of this nature. But try extra bypass condensers on the B-plus, screen and cathode leads.

R. McT. (Ashfield, NSW) renews his subscription and sends in a circuit for comment.

A. Thanks R.McT., for your subscription which has duly been attented to. With the exception of one point your circuit is in order. It will be necessary to use a separate diode load for the 6B7S and to connect to the amplifier through a coupling condenser of approximate value of .05 mfd.

K.T. (E. Brighton, Vic.) wishes to substitute types 6C6 and 80 for the 6SJ7-GT and 5Y3-G specified in the "Two Valve Short-Wave Receiver."

A. Yes, you could use the valves you have on hand and expect the same results as with the original receiver. The electrical characteristics of the 80 and 5Y3-G are identical while the difference electrically between the 6C6 and 6SJ7-GT is so small as to be negligible in this case.

A.N.B. (Perth, WA) requests information on operating conditions of cathode loaded 807 valves.

A. We regret that up to date we have not carried out any experiments with 807 valves in this connection and therefore we are not in a position to give any precise information on the subject. However, a cathode loaded amplifier was described in September, 1945, issue and the data given in this article may interest you.

A.F.L. (Cloncurry, Q'ld.). writes to tell of his experience with the "Little General" circuit which he built up as a dual wave receiver.

A. Many thanks for your letter which we read with interest, and we are glad to note that the "Little General" is doing such a fine job on the broadcast band. The gain of the type of set is limited however, and is barely sufficient for good results on the short-wave band. Because of this there is little tolerance for possible inefficiencies due to alignment or other circuit conditions. A certain amount of detuning is inevitable with variation in control bias, but hardly to the extent which is apparently evident in your receiver. Another point we don't quite understand is the apparent necessity for a bypass on the oscillator plate. This should prevent the oscillator from operating at all, and we can only assume that you are placing the bypass on some electrode other than the oscillator plate. We can supply a blueprint for the 1946 or 1947 "Advance" chassis and also for the "1946 Standard" chassis, the cost in each case being 2/6. On the other hand it should be possible to purchase any of these chasses through your normal supply house.

P.S. (Snowtown, Sth. Aus.) writes for an Australian Short Wave Handbook and tells us of his newly acquired amateur station call sign.

A. We trust that you will find the Handbook interesting. We have ideas of publishing a series of articles on aerial systems and transmission lines and are hoping to arrange for the appearance of the first of the series in the near future.

ELECTRICAL INTERFERENCE

A question frequently encountered in our query service relates to electrical interferences: "My set suffers with continuous crackling noises on some stations . . . what can I do to improve matters?"

IN the first place, crackling noises may originate in the receiver itself. A poor connection, a faulty component, a loose grid clip can all give rise to noises in the receiver itself.

The first step, therefore, is to check over the chassis making sure that all valves are properly seated in their sockets and that the grid clips grip the caps of the valves firmly. See that the valve shields are firmly on their bases and that the dial lamps are screwed hard down.

Check the power cord connections and see that the plug fits tightly into the power socket. The switch, too, should be checked to see whether its action is positive.

Leave the volume control of the receiver in its normal position for reception, remove the aerial and short the aerial terminal to chassis. If the noise persists, the indications are that it is either in the receiver itself or is entering the set through the power mains.

Intermittent noise often occurs in the audio circuits of a receiver, and some indication on this point can be obtained by turning the volume control to the full "off" position. If the noise is still evident, there is a good chance that it is in the set itself.

If, on the other hand, the noise is affected by the setting of the control, it can be assumed to be either external to the set or originating at some point in the circuit ahead of the control. Intermittent noise is generally difficult to trace, especially if it only occurs at infrequent intervals.

The usual procedure is to render the receiver operative, stage by stage until some idea can be formed as to just where the noise is being introduced. Leave only the output valve in circuit and let the receiver run for a suitable period until the noise is shown either to be present or absent. If still present, it may be a faulty coupling component to the previous plate circuit, a faulty valve or socket or a failing output transformer, to name the most likely components.

But if the noise is not evident, the audio voltage amplifier may be plugged in for a further listening test. This procedure can be followed stage by stage, right back to the converter or R.F. amplifier. Close examination of the faulty stage, or observation of the voltages may reveal the trouble. Otherwise trial by substitution may have to be resorted to.

Many servicemen operate signal tracers for just this type of work, but few enthusiasts have such an instrument available.

If there is still doubt whether a noise is occurring in the receiver, often the quickest way out of the difficulty, with a mantel set at least, is to take it to some friend's place and operate it for a few hours in a different location. If the noise is still apparent, it is safe to assume that it is inherent in the receiver, and expert attention is indicated.

But plenty of noise can occur in a receiver due to interference from nearby hair dryers, vacuum cleaners, or indeed any electrical equipment at all. Leakage current across high voltage line insulators, or tramway or railway cables are another prolific source of trouble. Such external interference is generally most noticed on the weaker stations, where the receiver gain is advancd manually or automatically to handle the weaker signal.

In bad locations, it is often impossible to find a complete solution to the problem of interference, and the set owner can only take the usual precautions and leave it at that.

Erect an aerial as far as possible away from the suspected source of the trouble and preferably high up outside and in the clear. Interference from power mains is usually confined to the immediate vicinity of the associated wiring, so that it helps to get the aerial right away from the wiring and high up. Take the lead-in to the receiver by as direct a route as possible, and avoid running it close to, or parallel with house wiring.

It is worth while to try the effect of an earth wire on the chassis, returned either to a service water pipe or to a separate pipe driven into moist ground.

As a partial precaution against line noise, a .01 mfd. mica condenser from either side of the power mains connection beneath the set to the chassis may be a help. Better still a proper line filter may be installed.

There is no general law for the suppression of interference. It is simply a matter of trying out various known measures in each case and observing which ones offer some advantage.

If the interference is coming from a single known source, as from a particular electric motor, a diplomatic approach to the owner may lead him to have condensers or filters fitted by the local electrician, thus minimising the interference at its source.

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Box 279 Haymarket P.O., Sydney.

A.R.P. (Ashfield, NSW) writes in appreciation of the "Short-Wave Handbook" and mentions verification cards which he has received.

A. Thanks for your appreciative remarks, in particular about Ray Simpson and his work.

G.K. (Melbourne, Vic.) submits for comment a circuit of a two-valve regenerative receiver.

A. Your circuit is generally in order except that the RF choke in the plate circuit of the detector is quite unnecessary. The detector plate load could well be 0.1 meg. The only other point warranting comment is the fact that you are supplying all three stages from the common B-plus supply without provision for decoupling. You may find that decoupling is necessary in the plate and screen circuit of the detector to prevent instability when the B-battery is weak.

J.B.T. (Toorak, Vic.) says he has had excellent results from the "Ferrotune Three" receiver and wonders whether it could be used successfully with a loop aerial built into the cabinet.

A. In the normal way loop aerials are tuned and this scheme would obviously be impractical with a ferrotune receiver which does not incorporate a gang condenser. The other approach would be to have a low impedance loop but this, in turn requires a suitably tapped aerial coil.

G.N. (Clayton, Q.) sends the requisite amount for Australian "Short-Wave Handbook" and tells us of the wonderful results he has had with the 1941 Advance and the Little General. In each case, the set was operated from 135-volt vibrator supply.

A. Your order for the Handbook has been duly taken care of, G.N. We are very pleased to note your success with both the sets which you mentioned, particularly from 135 volts HT supply.

R.F. (St. Peters, SA) asks for a copy of the "Short-Wave Handbook," and makes a number of suggestions.

A. Your copy of the Handbook has been forwarded in the usual way. The request for a short-wave converter is receiving our attention, but we can make no immediate promise about a wavemeter. Your request for the resumption of our broadcast band DX page is also noted, but we do not feel disposed to curtail other features to enable it to be included.

R.W.H. (Hampton, Vic.) asks a question about the tuning range of the R & H modulated oscillator.

A. You are quite correct in your statement that the tuning range would be affected by the series connection of the two sections of the gang. The broadcast coil does not cover the complete broadcast band, but the low frequency end is covered by the band which includes the 465 IF setting. These points were covered in the original descriptive article.

J.T.M. (Tammin, WA) requests a copy of the "Short-Wave Handbook" and reports successful results from the "1K5-four" receiver.

A. We are glad to note that you have obtained such good results from the set except for some apparent trouble with the reaction condenser. However, you give no hint as to what this may be, so that it is impossible to comment. As regards the chasses, blueprints are available for most receivers described in recent months, so that you can always obtain these for 2/6, and either make it up yourself or have some chassis manufacturer produce it for you. We can quite understand your sentiments about the lack of a-c supply.

G.C. (East Malvern, Vic.) has built 1Q5-One, but is somewhat disappointed with the results obtained. He also asks if broadcast stations verify listeners' reports.

A. You mention that you are using a coil from an old commercial receiver. It is possible that this is responsible for the poor performance, as modern coils are considerably more efficient than those of a few years ago. The life of the "A" battery depends on so many factors that it is impossible to give exact figures. Normally a single torch cell would last only a few hours with the "1Q5-One," but frequent rest periods may extend this considerably. Where portability is not required, a larger battery will give extra life out of proportion to the increased size and extra cost and so would be the better proposition. Some broadcast stations will send QSL cards, while others have discontinued this practice, so it is impossible to give a general rule.

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FOR SALE: Mark 3 No. 18 portable transmitter receiver new. Ideal CW-phone, 40 metre portable outfit, complete, £9/10/-. C 6770 A.W.A. Communication receiver converted AC perfect order, 200KC-28MC, £21/10/-. **J. Ellis, c/o Planet Radio Pty. Ltd., Hornsby. JU1080.**

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FOR SALE: 250 sprayed steel chassis suitable 5 valve radios standard parts, reasonable offer accepted. **Planet Radio Pty. Ltd., Hornsby. JU1080.**

FOR SALE: Kit for "R. & H." vibra-five, partly wired, all parts new, selling price, £9. Wanted 32v. D.C. electric razor. **Box 125 P.O., Bathurst.**

FOR SALE: Little Jim's Mate, all new parts. Complete with batteries and phones. Gives excellent performance, £6. **R. D. Barker, Guluguba, Q'ld.**

FOR SALE: 1 part finished windcharger, £6. 1 D-8 60 watt elec. soldering iron, £1. 1 crystal set, £2. 1 6v. elec midget motor. **P. D. Munchenberg, Veitch, S. Aust.**

FOR SALE: Small quantity: 1852; 1853; 9001/2/3; 954/5/6, 10/- each. **Max Moore, Box 102, Dubbo, N.S.W.**

FOR SALE: 1 Rola 6-12 Permag. speaker, 20/-, 2-5Z3 valves, 12/6 each. All as new. **L. Campbell, 33 Queen-st. Randwick.**

FOR SALE: Model electric motors, radio parts, cheap. **T. Gray, 35 Hill-st., Manly, N.S.W.**

FOR SALE: Little General, 2 weeks old, perfect reception, £10/10/-. **A Taylor, 9 Albyn-st., Bexley.**

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SELL: 4-valve portable (3 34, 1D8) less speaker and batteries. Also: 1Q5-GT, 1 30 valves 1¼ meg. pot., 2 Reinartz coils, £10. **J. Ashworth, "Auburn," Trangie.**

SELL: Shure DN 200 Dynamic Microphone 200 ohms, £13, sell for £6/10/-. Two A.W.A. pre-amp output trans. 6J7 Triode/500/200, £4 each. A.W.A. input trans. 50/200/Grid, £4/10/-. All new, unused. **"Radio," Box 2133X, Brisbane.**

Readers wishing to buy, sell or exchange goods are invited to insert an advertisement on this page. The cost is 1/3d per line; minimum charge 3/9. Approximately 5 words to a line. Advertisements for the next issue must reach our office by WEDNESDAY, JANUARY 14, 1948. Dealers' advertisements not accepted.

SELL: Unused valves 90-100 per cent. test 6K8G, 6C6, 6U7G, 10/- ea. 6C5G, 80 per cent., 7/6 ea. "R. & H." Jan.-Dec., 1946, 6d ea. Feb., Aug., Oct., Dec., 1942, 9d ea. Feb., Mar., May, June, Aug., Oct., Dec. Xmas issue, 1941, 9d ea. June-Xmas issue, 1940, 1/- ea. July, Aug., Dec. 1939, 1/- ea. Half wave trans. pri. 200, 230, 240 volt, sec. 70-230 volts, 7/6. Used carbon resistors, 2d ea. Small back panel dial (unused), 2/6. 2 Gang SW Cond. 150MMF, 5/-. Midget Conds. 25MMF, 2/6 ea. Iron cored IFTs 465kc, 5/- ea. Add freight. **C. Goodson, 23 Saunders-st., W. Coburg, N.13, Vic.**

SELL: Philips 5-valve communications receiver, in steel cabinet, 1.2 to 20 MCS., with B.F.O. pitch control, crash limiter, &c., 240-v. A.C. or 6-v. D.C. operation. Aligned, tested, complete with valves, power lead and plug, and headphones, £32. **A. J. Greenham, 131 Gladstone-road, Brisbane, S.1. J1996.**

SALE: Multimeter Scales Suitable for 0-1 Pullin Meters. Four Scales.—0-1000 ohms, 0-10, 50, 250, 1000 DC volts, Mills., 0-50, 250, 1000 volts AC, 0-10 volts AC, 2/- each. Post Free. Wanted "R. & H." Vol. 2; No. 4; Vol. 4, No. 7; Vol. 8, No. 12. **K. Evans, 17 Cambridge-st., Hawthorn, E.3, Vic.**

SELL: New Ferrotune 5-valve Mantel in high quality walnut cabinet. 6in. Magnavox speaker. Guaranteed perfect, £17/10/-. Portable 4-valve, 3in. spkr. Had little use. Perfect, £16, or near offer. **H. Swift, 22 Dundas-place, Albert Park, Vic.**

SELL: 8in. permag. speaker, one 2-gang one 3-gang condenser, 9 Kingsley coils, audio push-pull trans., 1 volume and 3 tone controls, 35 condensers, 40 resistors. Sundries. Sell separately if necessary. Send for list. **W. A. Franke, Barmedman, N.S.W.**

SELL: Duplex Single 1D8-GT, complete cabinet, new, £6/10/-, or best offer. **R. Vinicombe, 20 Codrington-st., Sale, Vic.**

SELL: One valve set without headphones, otherwise complete. 1J6G and other radio parts. **S. England, 6 Oakleigh-crescent, Ormond, Victoria. XU2626.**

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SELL: R.C.A. Mini Portable 4-valve B/C. Measures app. 2½" x 3½" x 9". Needs peanut valves, otherwise O.K. Offers. **T. F. Somers, 33 Horace-st., Malvern, Vic.**

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SELL: Set of "Radio & Hobbies" Vol. 1 No. 1 to present. Good condition. Best offer. **I. Lewis, 10 Haberfield-rd., Syd.**

SELL: Valves 1S5, 1R5, 1N5GT. 2 midget I.F. trannies., 5" speaker with trans., £5/5/-. **R. A. Scott, Church-st., Moruya.**

SELL: Communications receiver with power supply. A.W.A. 5 band from 200 kc to 30 MC, £24. **XL3373.**

SALE: FS6 transceiver with power supply and drawings. Best offer. **N. Boase, 36 Victoria-rd., Malvern, SE.4, Vic. UL6241.**

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WANTED to buy an Electric shaver, good make, 240v A.C. fifty cycles. Apply **G. Bezant, 50 Pallas-st., Maryborough, Q'ld.**

WANTED TO BUY: Kingsley AR7 receiver or similar. **Write to A. Atkinson, 65 Richmond-st., Maryborough, Q'ld.**

WANTED: "Radio & Hobbies," December, 1941; January, 1943; July, 1943. **J. Tait, 55 Portland-place, New Lambton.**

MODELS Technical Engineering Supplies. Castings and Blue Prints. New Enlarged Catalogue, 1/6. **O. Bolton, Room 1, 70 King St., SYDNEY.**

ANSWERS TO CORRESPONDENTS

J.M.T. (Broken Hill, NSW) renews his subscription for wo years and asks about sets operating from the 32 volt power mains.

A. Many thanks for your subscription and we note your interest in 32 volt receivers. It would not be possible to use a transformer to step up the voltage directly, without some vibratory system. Apparently the receiver you refer to uses one or more output valves designed to give reasonable operation with very low plate voltage. Certain imported valve types come within this category, but we cannot promise the description of such a set in the immediate future.

V.I.H. (Warwick, Qld.) expresses his thanks for the interesting articles in "Radio & Hobbies" and asks for a copy of the "Short-Wave Handbook."

A. Thanks for your encouraging remarks and a copy of the Handbook has been forwarded to you.

A.R.T. (Booleroo, Sth. Aust.) writes to inform us that he has been reading "R. & H." for five years and finds the articles very interesting. He asks the question of whether we are going to describe the addition of an RF stage to a short wave set using the 6AC7 orEF50 type valves.

A. Very pleased, A.R.T., to note your interest in "R. & H." over the last five years. You will, no doubt, have noticed by this the use of these valves in the RF stage of the "2JU Straight Eight," described in the Australian Short Wave Handbook.

P.S. (Snowtown, Sth. Aust.) writes for an Australian Short Wave Handbook and tells us of his newly acquired amateur station call sign.

A. We trust that you will find the Handbook interesting. We have ideas of publishing a series of articles on aerial systems and transmission lines and are hoping to arrange for the appearance of the first of the series in the near future.

W.G.S. (Toorak, Vic.) asks whether a standard RF pentode valve could be used as a converter by connecting the suppressor as the oscillator grid and the screen as the oscillator plate.

A. We are not overmuch impressed by your scheme, particularly as the suppressor grid is outside the screen and the transconductance between them would tend to be negative. This effect is actually utilised in the so-called dynatron oscillator, but all applications of the 57 to date as a converter have relied on its connection as an autodyne. Many thanks for your subscription and for your encouraging remarks.

W.J.R. (Newmarket, Brisbane) lodges an order for the Australian Short Wave Handbook and states that he holds every copy of "R. & H." since the first issue.

A. You should have your Handbook by now, W.J.R. We are very pleased to note your interest in "R. & H." and that you hold every issue. We also note that your son, VK4PR, is at Guam Island and, whilst awaiting suitable amendment to his call sign, is acting as "second operator" at KG5AD.

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